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The Fiscal Wharf at Tampico.

Tampico, the most important commercial port of Mexico, is a most interesting engineering locality. The importance of its site was recognized by the Mexicans for many generations, but the natural obstacles to navigation in the vicinity retarded its development. Finally the Mexican Central Ry. Co. undertook the task of making the great merits of the place available for commerce. The improvement of the entrance to the port under the direction of Dr. E. L. Corthell is a famous engineering achievement, while the construction of the railway lines radiating from the city has been equally important, although not so well known. More recently the company has constructed a finely equipped steel and concrete wharf which deserves more than passing mention.

This structure was designed by the late A. J. Tullock, assisted by Mr. Alfred Noble as consulting engineer, and is particularly interesting as representing the type of wharf which was considered most desirable in the light of experience gained when a cresoted timber dock at the same site was burned. The plan finally adopted provided for a superstructure of steel beams and concrete floor arches, resting on steel cylinders with piles driven inside them and filled with concrete. This construction probably makes the wharf the most fire-resisting structure of its type on the continent, and it is this feature which deserves most attention.

The use of timber piles in the Gulf ports is undesirable on account of their frequent destruction by the teredo, but it is not unlikely that in this case the non-combustible nature of the cylinder piers was also considered an argument in their favor. While the timber piles of some wharves which have been burned have remained serviceable for further use, this has not always been the case, and when it was not the work of removing the charred stubs has been tedious and costly. If, as in this case, the superstructure is to be of steel and concrete there is an additional reason for using heavy steel and concrete cylinder piers. Timber piling vibrates more or less under the shock of a vessel striking the pier, and such vibrations, which cylinder piers will prevent, would be highly injurious to a floor of the character adopted in this case.

The floor system itself is an interesting one. The main wharf, which is partly covered by a steel shed, is 1,200 ft. long and 75 ft. wide; at each end it is extended by a 700x50-ft. lateral wharf with its floor 3 ft. lower in order to accommodate small vessels. All portions have been designed for a live load of 800 lb. per square foot. In the main wharf the piers of each bent running out from the shore are connected by two lines of plate girders 42 in. deep, on which rest 15-in. floor beams on 3-ft. centers. Corrugated plates sprung between the beams support the concrete floor arches, which are nowhere less than 10 in. thick. Nailing strips are bedded in the concrete for the 4-in. plank floor. In the lateral wharves each bent of piers is connected by three 24-in. I-beams, into which are framed 18-in. floorbeams. The concrete floor is the same as that on the main wharf.

The great objection always raised in American ports to such a wharf is its rigidity when struck by vessels. At Tampico, moreover, where a high wind may blow a vessel with great force against the wharf, this point is particularly serious. A box girder 42 in. wide and 27 in. deep has accordingly been placed along the face of the wharf and filled with concrete. Its face is protected by a bulkhead of 12x12-in. timbers secured to the girder by galvanized bolts and straps so that they can be replaced whenever necessary.

This construction results in a wharf which is fireproof in every sense, not exposed to damage by the teredo, and very strong and durable. It is the type which has been frequently advocated for the ports of the North Atlantic States, although never adopted. It is to be hoped that the engineers of the company will furnish information concerning the experience with this structure and thus settle definitely the truth or falsity of the objections raised to the type by designers of timber wharves. The objections based on the high cost of the steel and concrete wharf can be readily understood, but those which concern its rigidity are difficult to grasp. The experience at the Tampico wharf should supply the desired information.

Blast Furnace Gas Engines.

One of the most marked features of present German practice in iron works is the abandonment of the steam engine in favor of the gas engine supplied with gas from the blast furnaces. Many of these engines are of large capacity, one at Meiderich being rated at 3,200 h.p. Their rapidly spreading popularity in Europe makes it strange at first sight that so little has been done in the United States along this line, for it is not often that important improvements are introduced in European mills without their early adoption here. The fact remains, however, that the large gas engine running on blast furnace gas is not generally regarded with favor in this country, and there is a very sound reason for this.

Blast furnace gas is not rich in comparison with coke oven gas, for example. It contains only about 1.25 per cent. of hydrogen in comparison with 39 per cent. in the gas produced in coke ovens, but it has about 24.5 per cent. of carbon monoxide in comparison with 3 per cent. in the other gas. It is this carbon monoxide that is the main source of its heat value, and the gas is consequently stable and capable of high compression, which renders its ignition particularly certain. On the other hand, it is not a clean gas, even when scrubbed, and particularly careful attention must be paid to keeping clean the interior parts of the engine using it. If this is not done an accumulation of dust and charred oil will form and gradually become so hot as to cause preignition and all sorts of troubles. So much annoyance was experienced years ago with early gas engines through such accumulations that the recollection of them may be a minor cause of the present objection to the use of blast furnace gas.

The use of blast furnace gas in such engines involves expenditures peculiar to its employment, as well as introduces economies by utilizing a waste product. The economy to be attained is best shown by considering the problem in a general way. The figures given for the purpose by various engineers differ somewhat. In an article in this journal last week data of this character were given on the authority of Mr. F. du P. Thomson, who was chief engineer of the Buffalo works of the Lackawanna Steel Co. during their construction. For present purposes, however, the figures given by Mr. Max Rotter in a paper recently read before the Illinois Steel Works Scientific Club will be employed. He states that in the average blast furnace the production of a ton of iron is accompanied by the generation of 10,500 lb. of gas having approximately 11,266,000 B.t.u. A part of this must be used in heating the blast, but if the gas is partially dried and cleaned before burning it in the stoves, about 76,000 cu. ft. having 6,580,000 B.t.u. will still be available for power purposes. If it is burned under boilers furnishing steam to compound condensing engines it will develop 235 h.p.-hr., but if used in a gas engine it will furnish, according to Mr. Rotter, 600 h.p.-hr.

Against this great saving of power due to the use of the gas engine must be set a number of expenses which are still hidden from most engineers desirous of learning the real facts in the matter. The cost of installing and operating a battery of boilers and a steam engine can be predicted closely, but the same is not true regarding gas engines. The cost of cleaning the gas is the first unknown item. For a 5,000-h.p. plant Mr. Rotter estimates that vertical tanks where the gas passes upward through a fine spray of water, centrifugal cleansers, water separators and a gasholder, the whole outfit occupying a 100x130-ft. area, will be sufficient. Against this estimate must be placed the long array of dust-catchers, coke scrubbers, centrifugals, filters, water separators and individual novelties with which each new German installation of any considerable size is equipped. It is practically impossible to ascertain their initial cost or the expense of operating them, although it is certain that they are necessary to obtain reasonably clean and cool gas.

The uncertainty does not stop here, however, for definite information concerning the engine itself cannot be obtained. Plenty of general statements can be secured, but the complete operating data of gas consumption, loads, labor and repairs of a large plant for a reasonably long period are conspicuously lacking in technical publications. The engine for use with blast furnace gas must be specially designed for its purpose, not only on account of the low heat value of the gas, but also to eliminate as far as possible the difficulties which an accumulation of dust will cause. The governing of these large engines is still an unsettled problem, particularly when they are direct-connected to generators. In addition there is a large amount of water required to cleanse the gas and to cool the engines, and in many situations the cost of providing this water will be great. Consequently, it is safe to say that until the experience gained abroad is made known in a reliable and definite manner the uncertainty concerning the cost of equipment and maintenance of blast furnace gas engine plants will prevent any considerable increase in their rating by American engineers.

Progress in Track Standardization.

The careful manner in which the American Railway Engineering & Maintenance of Way Association carrying on its work assures the high value of those procedures and types of construction which it adopts for its standards. As a general proposition standards are very desirable in civil engineering practice, but it must be confessed that they have a tendency to retard progress in small details. This tendency is not fully appreciated by some, who adopt standards readily and generally have occasion to repent their haste in doing so. The Association is making no such mistake as the record of the work of its committee on track well shows. This subject at first thought seems easily settled, yet the committee has found it necessary to spend several years investigating it. The time and care thus devoted to the work have their effect, however, in giving unusual weight to the recommended standards.

The first report of the committee on track was submitted in 1900 and was an informal communication from one of the members of the committee, on which no definite action was taken. The next year several papers on features of the subject were read by different members of the committee, and these communications were received as a progress report. In 1902 the committee made definite recommendations regarding the maintenance of line, maintenance of surface, maintenance of gauge, inspection of track and tools. The first two were discussed and amended at the meeting and then adopted, while the others were laid over for future action. In 1903 the committee's report was not considered on account of lack of time, but it was brought up in 1904, when the recommendations concerning standard rail drilling and blocking frogs and switches were adopted as well as a number of definitions. The action taken at this week's convention of the Association on the committee's report for 1905 will be reported in a later issue. This record of a single committee of the Association is typical of the work of all its committees.

The important feature of the Association's work is not, however, so much the thoroughness with which its committees discharge their duties as the care with which the reports are studied and discussed before adoption. A report that represents several years' study by specialists ought to be very carefully examined before it receives the final approval of such an important organization as this Association. The labors of the committeemen deserve such recognition and the dignity of the Association demands it. This has been fully recognized and an admirably edited bulletin appears at frequent intervals for the purpose of keeping the members in close touch with the work of all the committees. Consequently, when the annual convention occurs, all present have had an opportunity to become thoroughly familiar with the committees' suggestions as to standards and can discuss them thoroughly and expeditiously. In this way the work of the Association in standardizing all features of railway track is made both comprehensive and minute. It manifestly deserves hearty support, and railroad companies not already connected with the Association should join the large number which are now members.

Special and Standard Equipment.

The selection of equipment is a most important feature of every new undertaking which falls within the scope of engineering practice. To the purchaser and engineer alike the choice between so-called standard apparatus and special equipment presses home with peculiar force. For instance, a long-distance power transmission is to be undertaken at 60,000 volts. At once the insulator problem comes to the front. Are existing commercial types of insulators suitable to the conditions or should new designs be prepared and tested? With the experience thus far obtained, is it worth while to go to the expense of experimenting and redesigning, with the possibility of being finally unable to produce anything better than the open market now affords? The difficulty of correctly answering such questions in many cases constitutes a strong argument for the consulting engineer's services. It is with precisely this sort of question that the expert practitioner in special branches of engineering work is best qualified to deal. At the same time, there are a few general points which are worth bearing in mind on the part of both the engineer and his client. The subject may naturally be approached from three standpoints: the purchaser's, the engineer's and the manufacturer's.

A correct decision as to the equipment to be used implies the selection of that apparatus which shall most economically perform its work in proportion to its output or duty, throughout a series of years. Under this broad characterization of "economical" are included the elements of operating safety, efficiency and capacity, the factors of first cost, interest, insurance, maintenance, depreciation and taxes, together with the question of reliability and probable life. Manifestly, cases will arise where some of these factors are unknown for several years to come. Thus, in the 50,000-volt insulator problem, the element of depreciation cannot as yet be accurately predicted, because power transmissions at that potential have not yet been long enough in commercial operation for that question to be settled.

It is well to remember that in dealing with "standard" apparatus, the term is to a large extent relative. The conditions of engineering progress do not ordinarily permit equipment to remain unchanged in its details as manufactured from year to year. No hard and fast line actually exists, therefore, between different classes of equipment, but in general the term "standard" applies to that apparatus which the manufacturers are prepared to produce on a large scale without recourse to new designs, patterns, templates and perhaps new machinery. Special equipment involves, primarily, a new or revised design. It may or may not call for special material and workmanship. Doubtless it is true that if nothing but standard equipment were prescribed by purchasers and their engineers, there would be little real progress in the industrial arts. Naturally, as it costs less money to reproduce standard types of machinery, the manufacturer is justified in pushing the sales of such equipment as far as he believes it applicable to the proposition in hand. But many instances occur in which the conditions differ so widely from those encountered in previous practice that standard equipment is inadequate to meet the requirements.

Among a certain class of purchasers there is sometimes dissatisfaction if the consulting engineer recommends standard apparatus for their service. There seems to be a feeling that the cost of expert advice is not always justified in such cases, on the ground that the purchaser could have dealt with the manufacturers and their engineering departments directly. They forget that the quantitative choice of equipment still exists after the qualitative case of general type has been settled. Further, there is no doubt that in many cases the selection of standard apparatus represents the best professional judgment possible to exercise, while in still other instances good practice demands a departure from the equipment on the market.

The advantages of standard apparatus are, in the main, lower first cost, greater convenience in repairs and the experience already gained in the use of such equipment in representative installations. Special apparatus, on the other hand, is presumably better adapted to the requirements of the particular proposition for which it is prescribed; it may in the long run operate at less cost and with greater output and efficiency than the standard equipment which could be purchased at a lower first cost; and finally, it is almost certain to become standard if it is intelligently adopted in the first place.

The replacement of equipment before the expiration of what we may call its natural life, by newer and more improved forms of machinery, has for several decades been a remarkable characteristic of American industrial life. In so far as such equipment can be shown on rigid analysis of its possibilities to be capable of doing better work at equal safety and less expense per unit of work performed, than the old types, its adoption is praiseworthy. But in choosing between special and standard apparatus, there must be close discrimination if snap judgments are to be escaped. Of course, some propositions are of so simple a character that the lengthy consideration of anything but standard machinery would obviously be a waste of time. Thus, if one wishes to light an office building there is little object in selecting other than standard sizes of dynamos, or, if an electric railway is projected, no sane person would use special weights and sections of rail when the standard would fill the requirements.

At the same time, the conditions of most engineering problems are in some particulars unlike, so that it is always well to consider, at least briefly, the claims of both special and standard equipment before deciding upon that to be employed. Very often it will be necessary to conduct tests in the shop and laboratory before reaching a decision. High-class equipment is generally expensive in first cost, so that sometimes the question will come up as to the use of cheaper special appliances by other makers in preference to it. The problem can only be solved for each particular case, but in a general way it is well to specify standard apparatus if it will do the required work as economically as something of special design. Quicker deliveries can almost always be made in the case of purchasing established types of equipment, and the operation of the property may frequently be greatly simplified. Here, as in most engineering problems, the final question is that of making a dollar go to the economical limit, and securing results that inexperience could only obtain by a much greater expenditure. The exact reasons for the choice between equipments should, therefore, always be definite and clear.

Rock for Concrete.

Some reports on concrete work which have lately been received from a number of sources are of much interest through the indication they afford that the selection of materials for such masonry is gradually drifting away from the old rule-of-thumb methods towards the only logical procedure. It was formerly too often the habit to consider a slavish adherence to specifications inherited from the primeval days of concrete construction as the only safe course to follow. Very busy engineers and architects were content with that indication of progress which was shown by a falling price for materials, and neglected to look into the use of these materials and ascertain if they could not bring about an equal gain in economy by improving the methods of carrying out concrete construction. The great increase in the use of concrete has made it necessary, however, to revise the old specifications and rules for inspectors, but it has been apparent that in their revision there has still been a too strong desire to standardize them.

This is well shown by the result of attempts to produce a reliable and comprehensive specification for the broken stone used in the concrete. Some specifications prescribe the classes of rock which will be accepted, others limit the sizes of the pieces, others permit the run of the crusher, others reject stone which does not have sharp edges, and so on through a long list of requirements. The object of all of them is to procure a grade of concrete which will be satisfactory for the given purpose, and it is not at all unlikely that perfectly satisfactory concrete can be made from an aggregate which does not conform with most of these requirements; in fact, some engineers prescribe certain qualities for the stone and sand which they entirely neglect to enforce when the work begins, so that the onlooker is tempted to regard such requirements as embellishments rather than serious stipulations.

As a matter of fact, engineers are slowly coming to regard with considerable suspicion any very minute specifications for the stone or gravel to be used in concrete. Some specifications which are respectable mainly through their old age require the stone to be broken into cubes, a requirement which is impracticable with most good classes of rock, and is wholly unnecessary, anyway. Other specifications reject all the small product of the crusher, thus eliminating a very inexpensive material for filling the voids between the larger pieces of the aggregate. Other specifications permit the the run of the crusher, regardless of the fact that if the stone contains much mica the small particles from it should be carefully tested before they are used, for they may be distinctly injurious to the quality of the concrete. Some specifications prohibit the use of gravel, regardless of the fact that concrete made of some grades of gravel is much better than that in which some grades of broken stone have been used.

The obvious fact is that concrete can be made from such a great variety of materials that it is hardly practicable to stipulate broadly what may and may not be employed. It is much better to say that the materials and their proportions must be satisfactory to the engineer than it is to call for a 1:3:5 mixture, and then be compelled by local conditions to abandon these requirements. In many undertakings it is possible to ascertain when the specifications are prepared what materials are available for concrete, but this is not always the case, and the specifications should not be explicit when this is the condition. If the resident engineer is fit for his position he can determine whether the materials offered are suitable for the work and can fix their proportions. This fact is gradually being recognized, and some of the latest specifications for concrete practically place the decision for the selection and use of both sand and stone or gravel with the resident engineer. Such a course will probably result in concrete which is both better and cheaper than the old method of prescribing the proportions of the ingredients without any regard for the great variation in their properties.

Direct Lighting in Shops.

While much attention has been paid lately to the artificial lighting of shops there seems to have been little done in the way of bettering their direct lighting, although there has been abundant opportunity for such an improvement. The ideal illumination is that of the daylight, but unfortunately the methods of securing this ideal seem to be overlooked at times. It is hardly possible to estimate the cash value of proper lighting as an item in securing the production of a given piece of work at minimum cost, but anybody who has worked in a machine shop where his eyes are strained for half the working hours knows that good light is necessary for the best work.

With the rapid extension of reinforced concrete as a material for shops has come an increase in the size of window openings. By employing wired glass and metal sash plenty of glazing is not particularly expensive or short-lived. The large amount of window area which is now adopted for the best shops should be carefully considered, however, with respect to the character of the glass. Clear glass is generally out of place in a shop. It is not only of no particular benefit in illumination, but it is also a direct invitation to a waste of time in many cases. In one factory located on a small river, it was found that every time a large steamer passed by the shops most of the employees spent several minutes watching it go by. The foremen were ordered to keep watch on the amount of time lost in this way, and when their report reached the main offices it was found that the cost of opaque glazing would be repaid very quickly by the saving of time wasted in watching passing vessels. Just what glass is best for the purpose is still an unsettled question, although the investigations of Mr. Edward Atkinson made several years ago furnish much valuable information.

The overhead lighting offers a much more interesting problem, however, than that obtained through the side walls. Some ten years or so ago the old system of saw-tooth roofs employed extensively in Europe, particularly in textile mills, was introduced in the United States, where it has met with a warm reception, although a number of competent critics have opposed it as needlessly expensive. It is not applicable for a number of purposes, however, and the attention of mill architects is called to the system first introduced by Mr. George H. Pegram in the trainshed of the St. Louis Union Station and subsequently adopted for the South Terminal Station in Boston. In this system there is no monitor running longitudinally along the crown of the roof, but in its place a series of transverse monitors, if that expression may be used, with their vertical sides glazed. This system of construction permits as much overhead illumination as may be desired without placing any of the glazing in horizontal or approximately horizontal positions. While there are many situations for which flat glazing is not a disadvantage, it will sometimes happen that it is too much exposed to damage to warrant its use, and for such situations the transverse monitors offer an excellent substitute.

THE SERIOUS EXPLOSION of a boiler in a Brockton shoe factory on March 20, resulting in the death of many employees, was an occurrence which merits the most careful investigation. The boiler is stated to have been of 150 h.-p. and in good condition when last examined by the insurance inspectors. When it exploded it passed upward, tearing its way through the timber framing of the end of the four-story building above it, and then swerved diagonally downward, passing through a house 50 ft. distant and crashing into another beyond it. The frightful loss of life which followed the explosion and the revelation the accident affords of the potential destructiveness of boilers should draw the attention of all interested in such plants to the importance of good construction and careful maintenance.

THE COMPLICATION OF GAUGES with which the American mechanic must struggle is well shown in the valuable handbook on brass and copper issued recently by the Waterbury Brass Co. The company recommends using the micrometer gauge exclusively where accuracy is desired, and then explains the different systems it is forced to adopt. Sheet brass is generally made by Brown & Sharpe's gauge and sheet copper by Stubs' gauge. Brazed tubes are made by the Brown & Sharpe's gauge, but seamless tubes by Stubs' gauge. Wire is made by both Brown & Sharpe's and London gauges. The inertia of custom in maintaining a cumbersome complication of irrational measures is well shown by this condition.

COLLAPSES OF NEW BRICK BUILDINGS occurred in New York on March 19 and 20, and several more structures approaching completion or just finished show signs of weakness. There is consequently a great deal of irresponsible and disturbing talk in the newspapers about the reasons for the failures. The fact that the bricks from the fallen walls are generally clean is asserted to be proof of the claim that the masonry was laid in weather too cold for such work. The truth is that a number of causes may prevent mortar from adhering to brick, while, with careful work, brick can be laid in very cold weather without danger. Strong winds and dry air are worse than low temperature for winter brick-laying. It should also be pointed out that when owners refuse to pay for good materials and workmanship, architects are careless in supervising construction, and workmen are demoralized by labor agitators, there are plenty of other causes for falling walls than lack of effective supervision by the small corps of overworked inspectors of the Building Department. The latter, being public officials, are held responsible for every structural accident in the city, but this is a ridiculous trait of current journalism which is a mark of deep ignorance, and causes needless apprehension among the public.

THE STATE FORESTS of New York seem to be as badly in need of competent management as any great timber tract can be. The State Constitution requires these 1,500,000 acres of timber to be kept as "wild forest lands," and this held to prohibit planting, cutting down trees or removing those that have fallen through fire or other cause. An attempt to amend the Constitution to permit the sale of fallen trees is vigorously opposed by Governor Higgins, who says: "Experience has taught that if a preference is given to the removal of burned or down timber, live timber may speedily become burned or down timber." He points out, however, that a liberal policy of scientific forestry might properly be adopted. This is an excellent recommendation, for the maintenance of the timber lands and the preservation of runoff conditions are best insured by the careful work of the skilled forester. In fact, European countries have spent large sums for planting and maintaining timber lands mainly for the purpose of regulating stream flow.

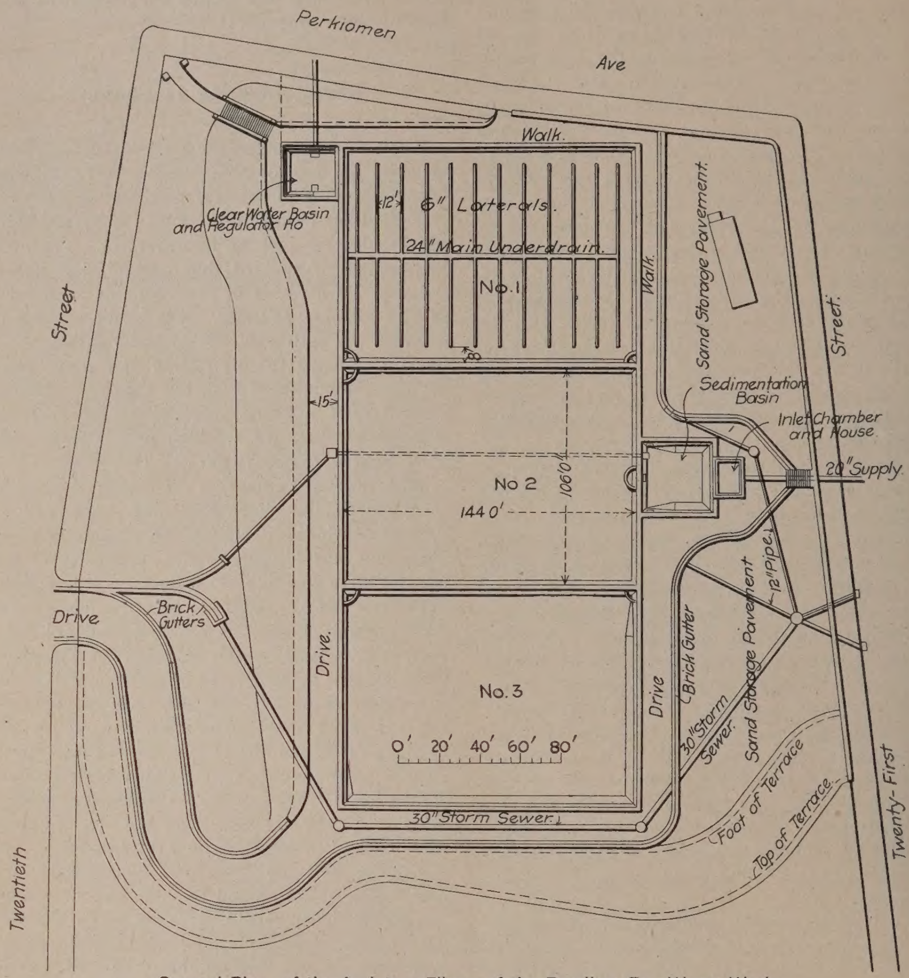
THE ANTIETAM FILTERS OF THE READING WATER WORKS.

The Second Slow Sand Plant in this City.

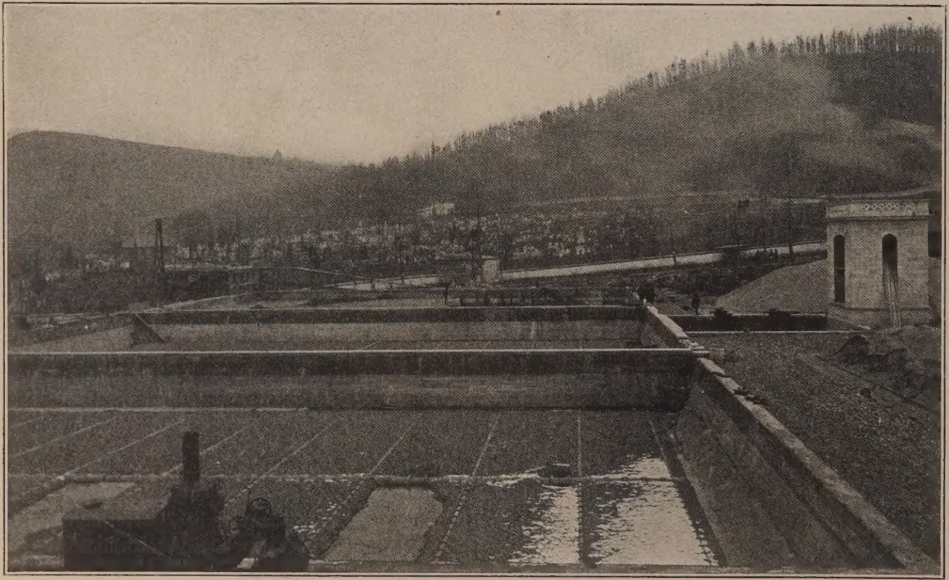
The second filter plant for the Reading, Pa., water works is now nearly completed, and when finished, will treat water from the Antietam supply, which comes from mountain streams with a drainage area of 5.44 square miles and is collected in a 101,000,000-gal. storage reservoir. The plant is located on the supply line from this reservoir to the city at a point where the hydraulic grade line and the supply line coincide in elevation, so that the discharge pipe from the filters has been increased in size to offset the head lost in passing the water through the sand beds.

The plant embraces an inlet regulator house, a sedimentation basin, three open sand filters, each with an area of a little over ½ acre at the surface of the bed, and a gate house built over a small clear water basin, arranged as shown in the accompanying plan. The inlet regulator house is a two-story building, 15x20 ft. in plan, built of tool-dressed Indiana limestone and lined with pressed brick. It is located over a concrete inlet gate chamber, 7 ft. deep, and of the same size as the building. A balanced float valve in this chamber controls the flow in the 20-in. supply pipe which leads from the storage reservoir through the gate chamber to the sedimentation basin. This basin is an open concrete and brick well, 9 ft. deep and 35 ft. square in plan. The 20-in. inlet pipe is connected in the basin to a 16-in. and a 12-in. transverse pipe spaced 12 ft. apart on either side of the center of the basin. Four aerators are placed on each cross pipe, two on each side of the inlet main, and the water is passed through them to remove any odor that may be present. The ends of the transverse pipe next the inlet chamber are fitted with gate valves in order that the raw water may be turned directly into the basin and not passed through the aerators, if desired. An agitator for mixing the raw water with a coagulant at times of unusual turbidity is inserted in the supply pipe. The coagulant will be mixed in tanks placed on the second floor of the inlet regulator house.

A separate 16-in. cast-iron pipe, in which the flow is controlled by hand-operated gates, leads from the basin to each bed. The pipe to the central bed terminates at the middle of the inlet end of the filter in a semicircular brick well, with a 12-in. wall built on a 5-ft. radius to the level of the sand surface in the bed. The brick in the lower 3 ft. are laid in cement mortar, while those of the remaining 18 in. at the top are laid loose so they may be removed as the sand surface is lowered by scraping.



General Plan of the Antietam Filters of the Reading, Pa., Water Works.



View during Construction Showing the General Arrangement of the Antietam Filters.

The beds are each 106x144 ft. in plan, and are designed to operate at a rate of 5,000,000 gal. per acre per day, with one bed in reserve for cleaning or refilling. The filter floors and the walls up to the maximum sand level are built of concrete. The remaining portion of the walls is built of brick laid in cement mortar, with a 6-in. bluestone coping and a veneer of sandstone on the exposed outside faces to harmonize with the buildings and retaining walls.

All parts of the filter beds and clear water basin below the sub-grade of the floors were brought to grade with alternate layers of clay and broken stone thoroughly consolidated by a steam roller. The first layer is of stone about 1½ in. thick. The successive layers are composed of 1½ in. of clay and 3 in. of broken stone, sprinkled with water whenever required during the placing. Crusher-run broken stone of a maximum size of 1½ in. and clay from the excavation were used in this work. The 6-in. concrete floors are laid directly on the finished grade. The floors of the sedimentation and clear water basins and of the filters were cut in squares of about 50 sq. ft., as the concrete was laid, by vertical metal forms extending through the concrete, and the joints left when the forms were removed have been filled with an asphalt mixture.

The underdrainage system consists of a line of 24-in. vitrified-clay sewer pipe, laid longitudinally down the center of each bed, and 6-in. transverse laterals of the same material lead from it. The floor is sufficiently depressed under the 24-in. mains to bring the bottom of the 6-in. laterals level with the top of it on either side, and its thickness increased to 8-in. The joints in the mains are made with a small jute gasket saturated with neat Portland cement, coiled and placed in the bell of the pipe and covered with mortar made of 1 part of cement and 1 part sand. The double branches for the 6-in. lateral connections are spaced on 12-ft. centers on the main, and have their vertical planes at right angles with the vertical plane of the main pipe and the horizontal plane of their tops in line with the horizontal plane of the top of the

n. The sections of pipe in the laterals were le with the bells cut away on one side so that barrel of the pipe rests for its entire length the floor. The joints are made with a ¾-in. ning, and the laterals are laid to within 8 ft. of side walls.

he depth of the broken stone over the underins, the thickness of the sand and the normal th of water are shown in the accompanying nsverse section of one of the beds. The lower 7 in. of stone passed a screen with a mesh of 2 n. and remained on a screen of 1-in. mesh. The next 2½ in. passed a screen of 1-in mesh and remained on one of ⅜-in. mesh. Above this are 2 in. of stone which passed a ⅜-in. screen and remained on one with a mesh of ⅛ in. The remaining ½ in. of stone passed a ⅛-in. screen, and was retained on one with a clear mesh of 1/16 in. The broken stone adjacent to the walls is left out, as shown in the cross-section, and all stone was washed until it was free from fine material.

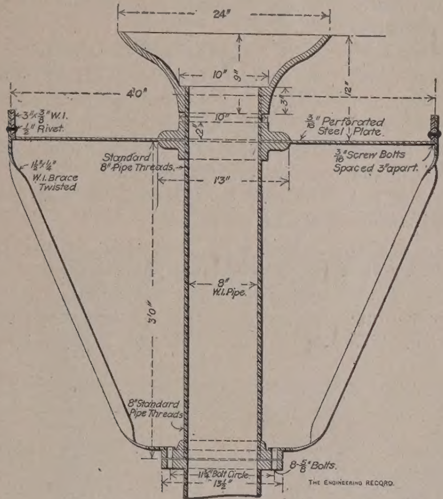
The filter sand is from the Delaware River near Wilmington, Del., and has a mean effective size of 0.27 mm. and a coefficient of uniformity of 1.44. It was placed in four layers, each about 1 ft. thick, from buckets handled by a cableway erected longitudinally across each bed. The first three layers were filled to approximate depths with their surfaces not particularly smooth, but the final layer was brought to an even grade.

The main underdrain of each bed is connected by a cast-iron reducer in the wall at the outlet end to a 16-in. cast-iron pipe leading to the clear water basin under the outlet regulator house. The general arrangement of pipes at the outlet end is shown in an accomanying cut. The piping of each bed is entirely independent of that of the other two, but the three outlet pipes are cross-connected in the clear water basin, and by the same connections joined to the waste-water drainage system. The rate of filtration is controlled by hand-operated gate valves on the outlet pipes inside the clear water basin, and a Venturi meter connected with an automatic registering device in the regulator house is placed in each pipe just before it enters the basin. The automatic devices registering the loss of head and the elevation of water in the filters and in the clear water basin are also in this house, and, together with the registers of the Venturi meters, were designed and manufactured by The Builders' Iron Foundry, of Providence.

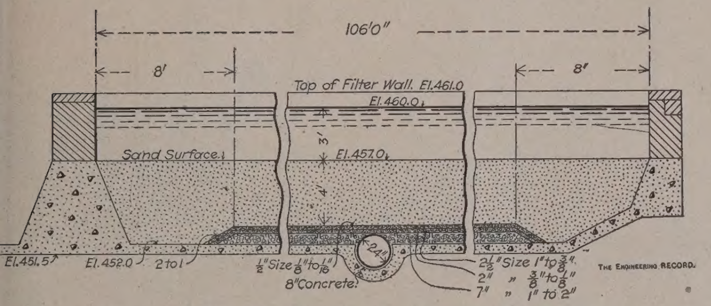
The one-story outlet gate and regulator house, 28 ft. square in plan, is built over the clear water basin, which is 12 ft. deep and has a concrete floor and side walls The regulator house is of Indiana limestone, and its general design conforms to that of the inlet regulator house. It is divided into two rooms, one an operating room containing the standards of the stems of the gate valves on pipes in the basin below and the automatic registering devices. The other room is for tools and storage.

A covered brick manhole is built just outside each bed near the effluent pipe, and samples of the effluent for bacterial and chemical analysis will be taken from a tap on a connection in each of these manholes with the adjacent effluent main.

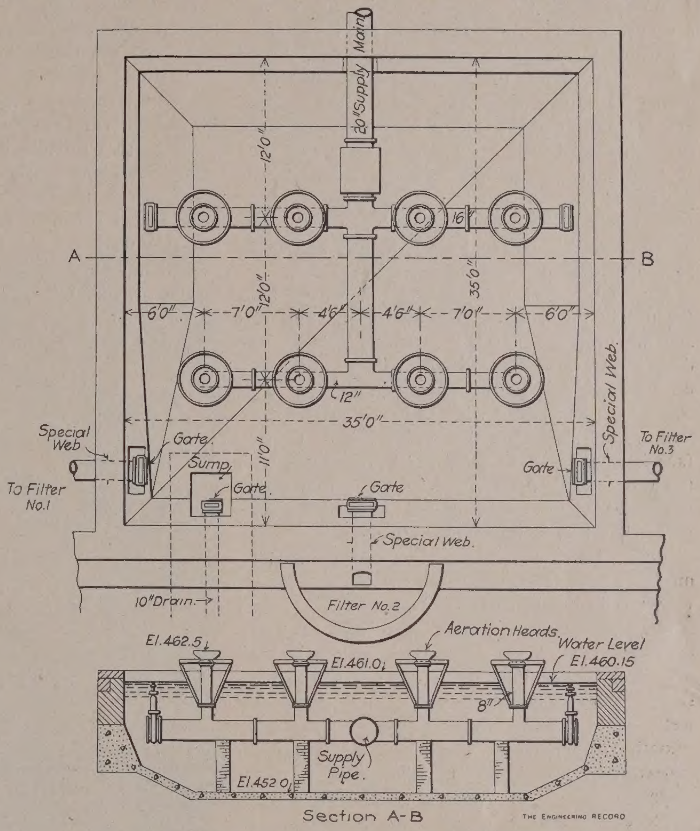
In order that the water may be drawn from the filters without passing it through the clear water basin, each main underdrain is directly connected by an 8-in. pipe, fitted with a gate valve, to a drainage manhole near the middle of the wall at the outlet end of the center bed. A 10-in. cast-



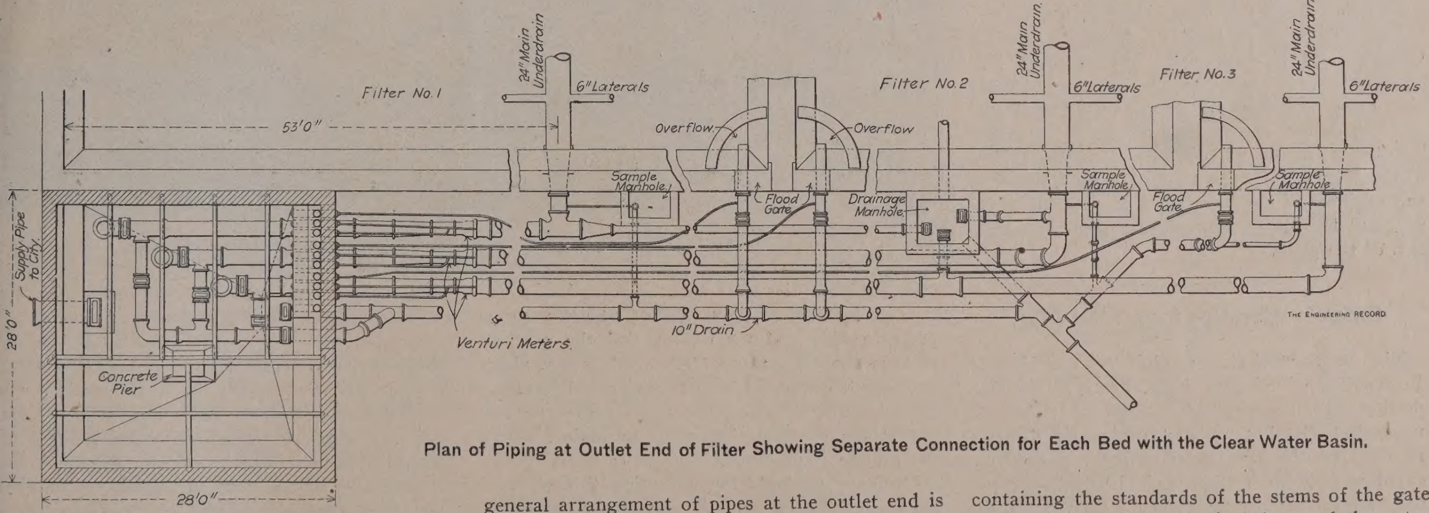
Cross-Section of Aerator Head.



Cross-Section of Filter Bed Showing Arrangement of Filtering Material.



Plan and Cross-sectional Elevation of Sedimentation Basin.



Plan of Piping at Outlet End of Filter Showing Separate Connection for Each Bed with the Clear Water Basin.

iron drain-pipe, laid in concrete 1 ft. below subgrade leads under the middle bed from a sump in the sedimentation basin to the same manhole, and the manhole is connected to the waste water system. A brick well similar to those at the inlet ends is built in one corner of each bed. A cast-iron pipe joins each well with the drainage system and permits the water to be drawn directly from the surface of the beds without passing it through the sand.

A flood gate, 3 ft. 6 in. wide, is built in one corner of each bed to facilitate the removal of ice which forms on the surface of the bed. These gates are similar to the one on the Egelman filter of the Reading water works, Engineering Record, Dec. 24, 1904, and the ice will be cut and removed through them in the same manner as is employed at that filter. Permanent cast-iron supports for the plank runs are put in on top of the division walls between the beds in order that the ice may be more readily cut in long narrow strips to be passed through the flood gates.

A portable sand washing plant has been built for use in this and the Egelman plant, and will also be used for a third proposed plant. The dirty sand will be stored until washed in the space on either side of the inlet regulator house. This space has been paved with 18 in. of coal cinders, laid in 6-in. layers and thoroughly rolled Its surface is sloped toward catch basins connected with the waste water drains, and it is also thoroughly underdrained to remove the water from the sand which has been scraped from the beds.

Most of the concrete was mixed in machine mixers. The proportions used, by volumes, were 1 part cement, 2½ parts sand and 5 parts broken stone. The stone was broken so that no piece exceeded 1 in. in its largest dimension, and all particles smaller than ¼ in. in diameter were screened out The mixture was made sufficiently wet, and the forms tight enough to produce a smooth surface which was made free from the appearance of stone by tamping with a spade along the face of the concrete as it was placed in the forms. After the concrete had thoroughly set the exposed surfaces were cleaned and given alternately, at intervals of 24 hr., two coats of a soap solution and two of an alum solution.

The filters were built by Messrs. Fehr & O'Rourke, of Reading, Pa. The cast-iron pipe and specials were made by The Reading Foundry Co. Lehigh Portland cement was used exclusively. The design was modeled after plans prepared by Mr. Allen Hazen, consulting engineer, New York. Mr. Emil L. Nuebling is superintendent and engineer of the department of water of Reading, and had direct supervision of the construction of the plant.

Concrete Envelope for a Steel Pipe.

The 18-ft. steel-pipe conduit of the Ontario Power Co,, of Niagara Falls, described in connection with the detailed account, in these columns last October, of that company's development of the Niagara Falls power, has been encased in concrete 1 ft. to 3 ft. in thickness. At the time the articles mentioned were written, the 7-in. bulb tee stiffeners, spaced 4 ft. apart along the pipe, had alone been provided to assist in carrying the 4 to 12 ft. of superincumbent sodded earth under which the line runs hidden through Victoria Park. It will also be of interest to add that each of the three 18-ft. conduits, which the plans of the ultimate development comprehend, will regularly supply six 9-ft. turbine supply pipes, but it is now determined that a seventh such pipe may be supplied either from conduit No. 1, through a cross-connection, or directly from conduit No. 2. The 18-ft. pipe is designed to carry about 4,000 cu. ft. of water per second at 15 ft. per second.

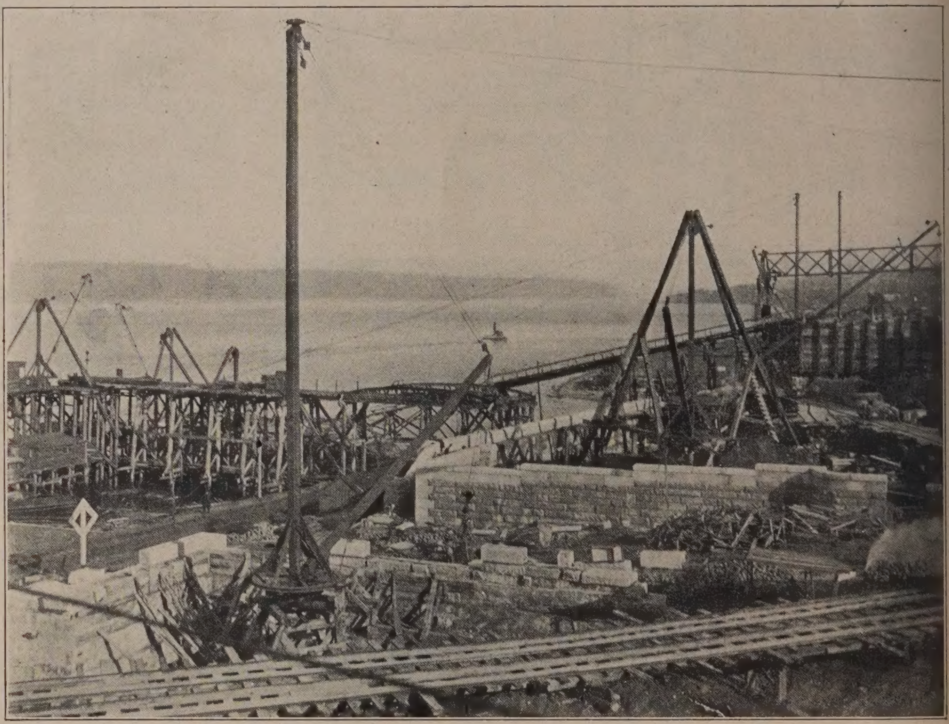
The Construction of Section 2, Riverside Drive Extension, New York.

The second contract section on the extension of Riverside Drive in New York extends about half a mile north from 135th St. to 145th St., and has a width varying from about 150 to 250 ft. The level of the road is at an average height of about 60 ft. above the adjacent tracks of the New York Central R. R., which lie between it and the North River. The west retaining wall between the driveway and the tracks has a concrete footing with a uniform depth of 5 ft. and a maximum width of 30 ft., supported in some places on piles, and elsewhere carried down in sheeted trenches to rock or to a satisfactory sand. A granite wall 75 ft. in maximum height, with battered face and an offset on the back, is built on this footing and backed with rubble masonry. The construction of this wall and the excavation and back-filling, together with the smaller walls, approaches, stairways, ornamental work, sewers and two cut-granite arch bridges of 40 and 50-ft. span, constitute the principal items of work on this section. The principal quantities were about 20,000 yd. of granite ashlar masonry, 60,000 yd. of concrete, 40,000 yd. of rubble and 5,000 piles, and the contract price is about $1,500,000. The work is now about one-fourth completed, and is under full headway with a force of about 250 men at the site and 150 at the contractor's quarry in Maine, where the granite is procured.

Ordinary methods for executing this class of work are adopted, and the contractor has established a line of nearly a score of boom-derricks located on the bluff inside the western retaining wall to command both excavation and masonry and handle materials to and from a double-track standard gauge railroad which runs the entire length of the section close to the face of the retaining wall to deliver materials. The derricks are of about 115 tons capacity with booms from 60 to 75 ft. long, and are operated by Lidgerwood, Lambert and Rawson & Morrison hoisting engines, nearly all of which are driven with steam from a 250-h.p. Heine boiler at the concrete plant. The steam pipe is carried along the line about 1,000 ft. in each direction and is protected by a jacket of air-cell covering enclosed in canvas and an outside layer of tar paper. On account of the difficulty in extending the line as quickly as it is needed, two locomotive boilers have been temporarily installed to operate some of the derricks near the north end of the line. Rubble stone is received from excavations in different parts of the city, and is delivered by trucks which usually unload it at the points required by the masons, thus avoiding twice handling for storage. All other materials are distributed by the service tracks.

As the surface of the ground is very irregular, the service tracks are carried in many places on a timber trestle and by short-span bridges. They are graded in both directions from a summit near the middle where a hoisting engine is located; each drum independently operates a cable so that the cars are drawn from both directions to the summit as desired.

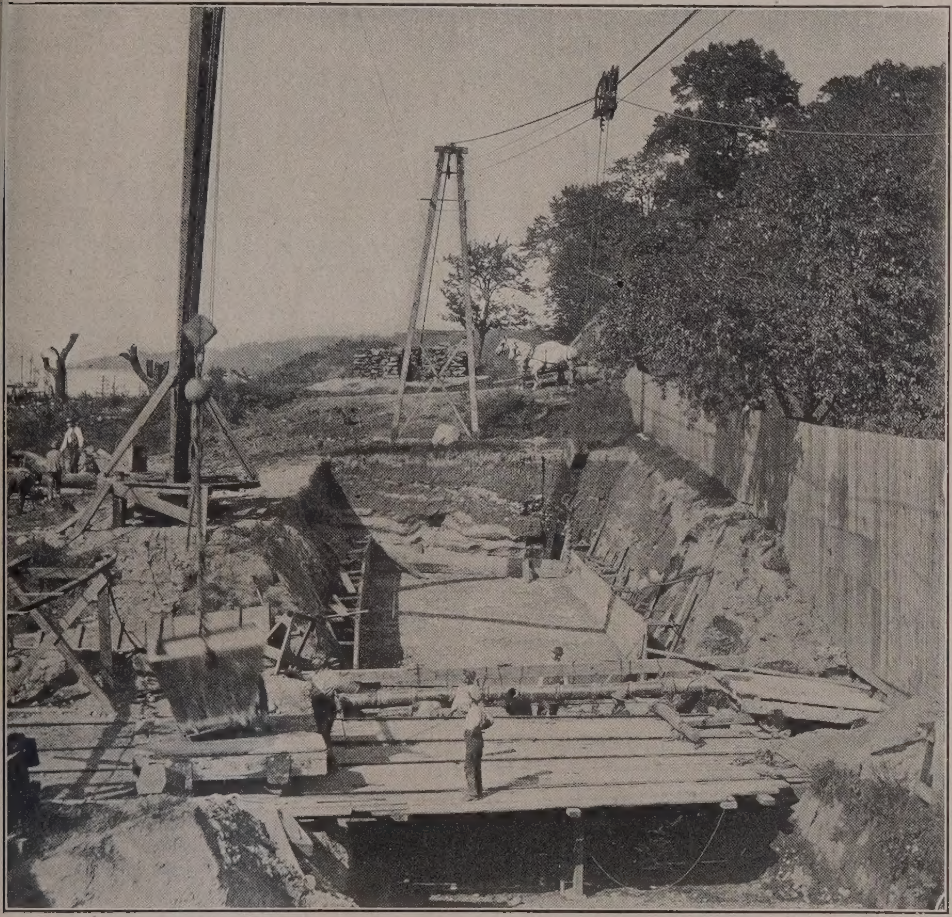
The most interesting feature on this section is the plant for unloading materials at the dock and for mixing and handling concrete, which is so arranged that all operations are nearly automatic and continuous, and involve a minimum of hand labor. Near the middle of the section, the contractor has built a pile dock and opposite it, on the other side of the railroad tracks, has established the concrete plant. A standard gauge railroad, transverse to the line of the work, is carried from the dock to the double-track service road on a trestle and overhead bridge crossing the Central tracks. This delivers granite from schooners to the line of the work. Parallel to this track there is a Robins belt conveyor about 350 ft. long raised about 5 ft. above high water at the river end and 52 ft. at the shore end. It has a movable S-shaped tripper, and is made with a 24-in. belt driven by a separate small engine at a speed considerably faster than a walk.


Contractor's Dock and Concrete Plant, Section 2, Riverside Drive Extension.

A derrick on the dock unloads sand, gravel, coal, or loam for back-fill, which is removed from the scows by a clam-shell bucket and emptied into a hopper discharging on the conveyor belt. The tripper is set to deliver coal to a 250-tone storage bin, loam for top dressing on the fills to dump cars on the surface track, and sand and stone to storage bins of 1,200 yd. capacity. Cement is received at the dock and delivered by the derrick

100-bag batches to the conveyor, where it is ut by hand on the belt which runs so fast that is not practicable to place the bags less than 0 ft. apart on it. The bags go through the tripper, and are delivered at the upper end of the onveyor into a chute, which deposits them in a torage house of 3,000 bbl. capacity, where they re piled up as fast as received.

The six sand and gravel bins have flat bottoms bout 6 ft. in the clear above the surface of the ground and are arranged in a continuous row with their center line in the same vertical plane as that of the conveyor. Beginning at one end, here is a stone bin, sand bin, two stone bins, a sand bin and another stone bin. In the bottom of each bin there is a transverse row of five 12x 12-in. openings closed by horizontal steel slides operated by hand levers. In the vertical plane of each row there is a surface track about 50 ft. long which extends about 20 ft. beyond the ends of the bins. Between each pair of tracks there is a 6x6-ft. sheeted pit about 4 ft. deep, in which there is placed a 2-yd. wooden charging box suspended by six chains.



Concreting Wall Footings with Cableway on Section 2, Riverside Drive Extension.

Stone and sand from the storage bins are delivered to measuring cars on the surface tracks; these cars are proportioned to receive the exact amount required for one 2-yd. batch of concrete. They are then pushed by hand opposite the pits and discharge their contents through side flap doors and chutes into the boxes, sand from one side and broken stone from the other side. Cement is wheeled down the short incline from the storage house and is emptied by hand into the boxes, and the latter are hoisted out of the pits and conveyed to a cubical Carlin concrete mixer by means of a trolley hoist moving on an overhead wooden Howe truss bridge 75 ft. long and about 50 ft. high in the clear. Hoisting and traversing are both accomplished by a double-drum hoisting engine. The concrete mixer discharges into 2-yd. steel buckets made by the Cyclopean Iron Works, Jersey City. The buckets are seated on small flat cars on the main service track, which are immediately drawn to the required position by the cable traction already described.

With this system as much as 250 yd. of concrete have been put in the work at a considerable distance from the mixer in one 8-hr. day. The capacity of the plant is only limited by the rapidity with which the finished concrete can be removed and put in place. The conveying apparatus can unload cement from the boat to the store house at the rate of 1,000 bags per hour at a cost of about ½ cent per bag.

The concrete mixing, measuring and storage plant is substantially the same as that used by the same contractors for the work of the New York anchorage of the Williamsburg bridge and described in The Engineering Record of June 18, 1898. The conveyor plant was also used by the same contractors for the construction of pier 1 of Bridge No. 4 across the East River at Blackwell's Island, New York, and was illustrated in The Engineering Record of December 13, 1902.

Besides the plant already enumerated, the contractor has the usual outfit of dump cars, steam pumps and miscellaneous apparatus, and is using a 2-yd. orange-peel bucket for earth excavation. Work on this section was commenced as soon as frost was out of the ground last spring, and after the principal footings were sufficiently advanced, work on the drains and sewers was commenced and is now nearly completed. Excavation, concreting and the building of rubble and ashlar masonry is progressing rapidly, but little backfilling has yet been done. This work was designed, and is being executed under the direction of Mr. F. Stuart Williamson, consulting engineer.

The Ryan-Parker Construction Co. is the contractor, Mr. James J. Smith, superintendent.

The Revised Plans for a Fire-Protection Water System for New York.

A year ago plans for a high-pressure water service for fire protection in New York were prepared by Mr. Nicholas S. Hill, Jr. at that time chief engineer of the city's water department. Why these plans were not carried out has never been made public. Since Mr. Hill's resignation various modifications of them have been suggested, and some weeks ago Mr. I. M. De Varona, who had successfully carried through similar work for the Borough of Brooklyn, was made acting chief engineer of the Manhattan works, and assigned to the untangling of the trouble which has arisen since Mr. Hill's resignation. Mr. Varona's plans are practically identical with those adopted in Brooklyn, although the system is planned on broader lines. He proposes to protect the same area as that suggested by Mr. Hill, the so-called dry-goods district of the city from the City Hall north to Twenty-fifth St., and from the North River east to Second Ave. and East Broadway. Provision is made, however, for a considerable extension of this high-pressure district if it becomes necessary. Within this area it is proposed to lay mains and erect two pumping stations with a capacity of 30,000 gal. per minute, but capable of receiving additional machinery bringing the capacity up to 48,000 gal. per minute. The Fire Department rates its engines at 250 gal. per minute, and there are about eighty of them in Manhattan and the Bronx, a total of 20,000 gal. fire engine pumping capacity. These figures give a good idea of the capacity of the proposed works.

The plans provide for two stations to be built at present, with a possible third station if the extension of the system makes it advisable to increase the available supply. One is near the Gansevoort Market on the North River, and the other on the East River at the corner of Oliver and South Sts. These sites are outside the districts of high fire risk. They are designed to furnish either fresh water from the city mains or salt water from the waterfront, as seems most desirable.

The stations are to be entirely of fireproof construction, and of sufficient size for eight pumping units at each station, the present installation to consist of five units. Provision will also be made for an independent engine to be used for street flushing and sprinkling, although it is probable that this engine will not be installed until after the fire service engines have been erected.

At present there are not definite data as to the amount of water or the pressure at the hydrant that the Street Cleaning Department deems necessary for its use, and until this is obtained the size and design of the pump cannot be fixed.

The motors are three-phase 25-cycle, 6,000-volt electric motors, running at a speed of about 735 r.p.m. This is the simplest form of motor at present in use and has been extensively employed to drive both pumps and other types of machinery. The pumps are to be of the centrifugal multi-stage type. Each stage of the pump can increase the pressure about 50 lb., and a 6-stage pump is required for 300 lb. pressure. While a relief valve will be provided for additional precaution, the pumps nevertheless will practically take care of themselves, as they churn water when the pressure rises to the maximum for which they are designed, and no damage results from not properly setting the relief valve. This type of pump was adopted on account of its extreme simplicity and the small amount of space occupied by the pump and motor.

A two-stage centrifugal pump, driven by a steam turbine, has just been started at the Mt. Prospect pumping station in Brooklyn, which has shown a capacity of 6,600,000 gal. in 24 hours against a pressure of 72 lb. The contract capacity was 6,000,000 gal. In the Schenectady waterworks two centrifugal 2-stage pumps are installed, working against a pressure of 110 lb. and with a capacity of 12,000,000 gal. in 24 hours. They are directly connected to 800 h.p. 3-phase 40-cycle induction motors. The Buffalo waterworks are about to install two-stage centrifugal pumps of 25,000,000 gal. capacity, operating against 70 lb. pressure, direct connected to 1,250-h.p. 3-phase 25-cycle motors. The Youngstown fire department operates a centrifugal pump of 500 gal. per minute capacity against a head of 175 ft., driven by a 40-h.p. 400-volt 2-phase induction motor, with a speed of 840 r.p.m.

The electric current necessary to run the stations will be furnished by the New York Edison Co. at a pressure of 6,000 volts. This company has six steam generating and distributing stations. These stations are also partially equipped with rotary converters and storage batteries, so that in case of a breakdown of the machines, the storage batteries and converters can be put into use. It also has feeders from the Brooklyn Edison Co.

The general piping scheme is to have two 24-in. discharge mains leading from each station. These mains bound almost the entire area to be protected and run from one station to the other. Sixteen and 12-in. mains are to run in streets paralleling and intersecting these, and will be cross-connected at frequent intervals by 20-in. mains. The water has to travel only a short distance through a main smaller than 20 in. before it reaches the hydrant from which it is to be drawn. All mains are cross-connected at the points of intersection, so as to obtain the most perfect circulation possible. With this cross-section, and with gates located at the end of every block, except for the very large mains, where the gates are spaced about two blocks apart, it is possible to repair a break in any single block without affecting any hydrants except those located on the block in question. Careful computation of the frictional losses in the mains shows that the full capacity of both stations can be delivered in any section within the area at present proposed with a pressure at the base of the hydrant of about 250 lb. per square inch.

Under the proposed plan, the hydrants are always within 400 ft. of any building in the district, and there are sufficient hydrants so that, if any block were on fire, 60 streams of 500 gal. per minute, or the full capacity of both stations, could be concentrated on a block with a length of hose not exceeding 400 to 500 ft., assuming the use of 3-in. horse and 1¼-in. nozzle.

THICKNESS OF CAST IRON FIRE SERVICE MAINS.

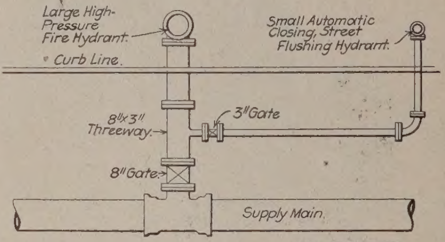
Size of pipe.	Thickness.	Unit tensile strain with 300 lb. pressure.	Factor of safety.
24 inch	1⅞ inch	1920 lb.	10.4
20 inch	1½ inch	2000 lb.	10.0
16 inch	1¼ inch	1920 lb.	10.4
12 inch	1 inch	1800 lb.	11.1
8 inch	⅞ inch	1371 lb.	14.6

The special castings for the large 3-way and 4-way branches, where they are weakened by the area cut out for the branches, are to be made of steel and a very large factor of safety provided. The other specials are made of cast iron and are also designed with a very large factor of safety. The joints shown in the illustration are of a special form to meet the requirements of the high pressure. There are deep double lead grooves in both the spigot end and hub end. Tests made with the ordinary 12-in. lead joint showed that it held up to 750 lb. per square inch, which was the highest test pressure obtainable, and with the grooved joint it would not seem possible that any difficulty can be experienced.

As under normal conditions there will be little or no flow in the main, they are to be laid so that the outside top will be at least 5 ft. below the surface of the street ,or about 1½ ft. below frost line. Where it is necessary to bring the main closer to the surface, special arrangement will be made to prevent freezing, and during the winter months water will be slowly pumped at frequent intervals from one station to the other so as to change the water in the mains.

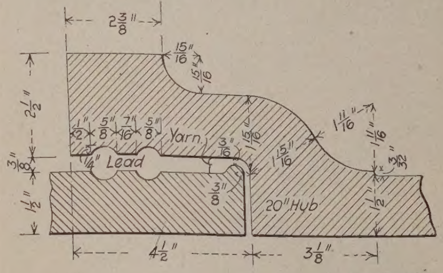
The gates or stop-cocks are to be of cast iron, and none larger than 20-in. will be used in the system. All gates 12-in. and larger are fitted with by-passes so as to relieve the pressure on the disc, and for the 24-in. mains 20x24-in. reducers are to be used with the 20-in. gates. The stems for the gates are to be of nickel steel, in order to combine extreme strength with freedom from corrosion, and all other working and bearing parts are to be of bronze composition. The gates are to have flanged ends with a short ball or spigot piece bolted to the gate so that in case of a break in the gate it can very quickly be removed and a new gate placed in position.

The more important requirements for the hydrants are that the main valve will be so designed that the pressure of water will tend to close it; that bronze be used for all metal parts of the valves and valve seats; that no movable iron part shall come in contact with cast iron; that there shall be four nozzles, one 4½-in. and three 2½-in. standard outlets; that all outlets shall be controlled by independent valves of composition having rolled Tobin bronze stems; that the clear water-way through the main valve shall be not less than 28 sq. in., and internal diameter of the standpipe not less than 9 in.; that the inlet at the base of the hydrant shall be 8 in. internal diameter and flanged; that the hydrant shall be so designed that all valves, seats, spindles, etc., can be removed without disconnecting the hydrant; that the main valve and drip valve cannot be opened together; that the main valve can be opened and closed by one man, using a 15-in. wrench, when the hydrant is under the maximum working pressure of 300 lb. per square inch; that the fireboat connection hydrants shall have two 3½-in. fire department standard female connections to fit with the fireboat connections; that each hydrant shall be tested under 300 lb. and 600 lb. pressure, both with the main valve closed, and with the main valve open and independent valve closed; that the hydrant shall be perfectly tight under 300 lb. pressure and not show a greater leakage than ½ oz. per minute under the 600-lb. pressure. Hydrants submitted for Brooklyn which are practically the same as those for Manhattan, are very substantial in appearance, and are apparently designed so that they will answer the requirements without difficulty.


Large High-Pressure Fire Hydrant.
Curb Line.
Small Automatic Closing, Street Flushing Hydrant.
8"x3" Threeway.
3" Gate
8" Gate.
Supply Main.

THE ENGINEERING RECORD.

Fire and Street Flushing Hydrants.



THE ENGINEERING RECORD

Joint for High-Service Mains.

The system of mains has been so designed that it can be used for street cleaning purposes, but special care has been exercised in so doing to avoid any reduction in the efficiency of the system from a fire standpoint by the street cleaning appliances. On each hydrant branch a 3-way branch has been set between the cap and the hydrant, and to this will be connected a small cast-iron gate with a flanged pipe leading to the street cleaning hydrant, as shown in one of the illustrations. The hydrant will be so designed that the supply of water will be cut off from it when the pressure in the main rises above any prescribed limit, say, 70 lb. This provision is necessary to prevent injury to the men in the street cleaning gangs when at work sprinkling or flushing, if, while doing this work, the pressure is suddenly raised without warning. The street sprinkling and flushing hydrants will be of a shape entirely different from that of the hydrants in use, as well as those to be installed for the high-pressure fire system.

To provide the requisite water for street sprinkling and flushing, independent pumps will be ultimately installed at the stations, as the high-pressure pumps are unsuited for this service. As at present there are no definite data as to the amount of water and pressure needed for street work, the installation of the special pumps will be delayed until these points are definitely settled. In the meantime the high-pressure fire-service pumps will be temporarily used. A system of telephone boxes is proposed similar to that in use by the Police Department, the boxes being located so that a fire in any part of the district can be watched from at least one of them, and orders transmitted to the engineer at the pumping station in regard to the requisite pressure and amount of water, as well as to the use of fresh or salt water, thus saving invaluable time. These boxes have been successfully operated in the Philadelphia system.

Measuring Underflow.

The method of measuring the flow of ground water which was invented by Prof. Charles S. Slichter, of the U. S. Reclamation Service, has recently been employed extensively by Mr. Homer Hamlin at Los Angeles and in the San Fernando valley. As a result of his experience he makes the following suggestions concerning the method:

(1) The location of the section where it is proposed to test the underflow should be carefully studied. It should be, if possible, in a straight stretch of the valley, and at some distance, either up or down, from large tributary streams.

(2) The form and slope of the water table should be ascertained and the line of test stations should be placed most advantageously.

(3) In order to secure accurate results, the testing stations should be close together along the line of the section.

(4) The well screens should be short, and the ground should be tested at intervals of 2 to 4 feet in depth, down to bed rock when possible.

(5) If possible, the porosity of the pervious beds should be determined.

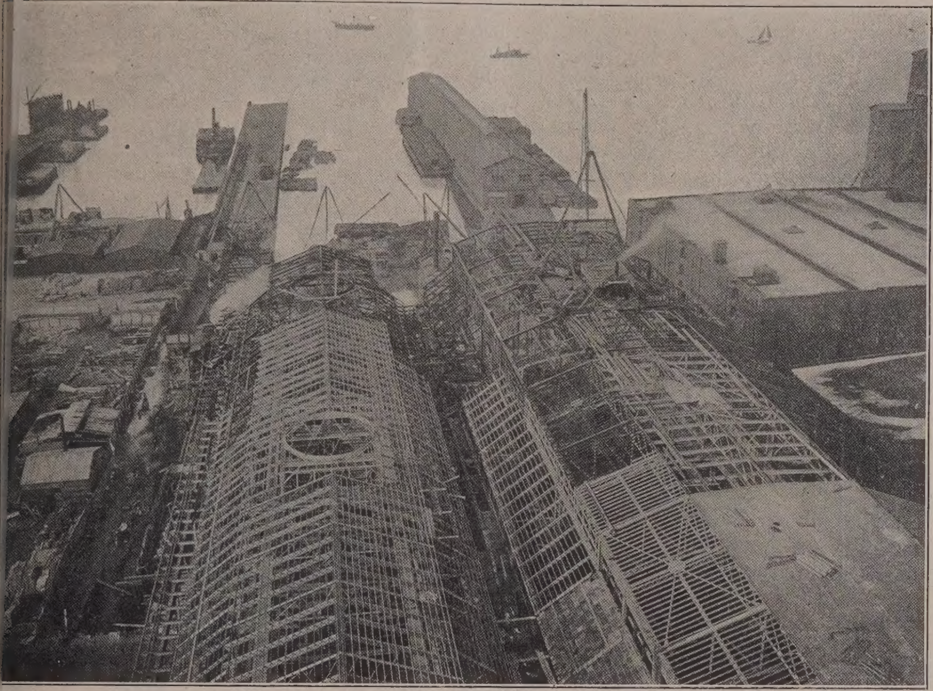
(6) In making deep tests some form of drive pipe and screen, such as is described in this report, should be used.

(7) Recording ampere meter and switch clocks should be used. The discharge from a given section will undoubtedly be far less than is expected, the popular tendency being to greatly overestimate the amount of underflow. Even if the results obtained by this method of testing are not so accurate as desired, they are, nevertheless, of great value as they enable investigators to compute, approximately, what could only be roughly estimated before.

A 5,000-KW ENGINE-DRIVEN UNIT in the subway power house, New York, has been started in less than two minutes.

ection of the Power House of the Subway Division, Interborough Rapid Transit Co.

'he power house of the subway division of the erborough Rapid Transit Co., of New York, ich was described in detail in The Engineer- Record of October 1 to November 5, 1904, lusive, has about 12,300 tons of structural steel n the framework. It is divided longitudinally nto a boiler room and an engine room; the former contains four tiers of floor beams below he coal pockets and the latter has one main floor and six gallery or mezzanine floors on the sides of the full height central room.



Completing the Erection of the Power House.

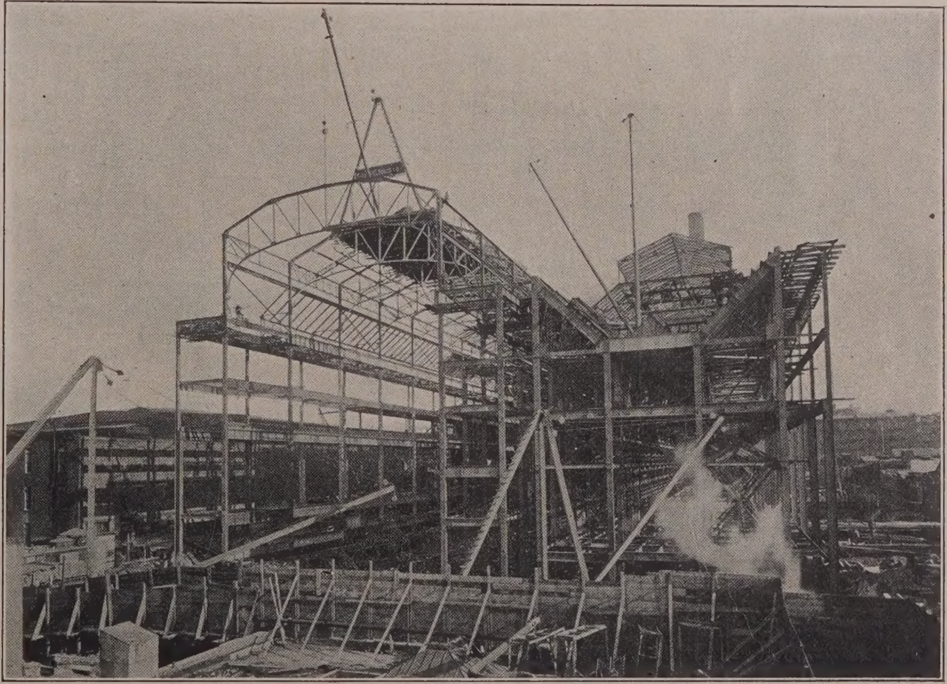
The framework has 58 transverse and 10 longitudinal rows of columns with riveted web connections to the floor-girders, which are generally plate girders from 2 to 4 ft. in depth provided in some instances with solid-web kneebraces. In the boiler room twin columns and double lines of girders carry the two tiers of boilers, and in the engine room and between it and the boiler room the gallery floors are proportioned for heavy loads. Special runway girders 4 ft. deep and 36 ft. long are provided for the 50 and 25-ton traveling cranes. The six 1,200-ton brick smokestacks 250 ft. high are each supported 50 ft. above grade on six extra heavy steel columns and a horizontal platform of massive plate girders and deep I-beams. The width of the 81-ft. boiler room and two stories of its height is occupied for the full length of the building by coal bins of 18,000 tons capacity, made with transverse bents of double horizontal and inclined plate girders and floors of I-beams and concrete slabs. Elaborate transverse bracing and horizontal trusses are introduced to provide for horizontal stresses and wind pressure, and the roofs are made with long-span riveted trusses and a trussed monitor. All of these heavy and elaborate members made a structure of unusual magnitude and great complexity, which has been successfully erected by simple methods and ordinary plant.

At the commencement of operations a 20-ton guyed derrick with a 75-ft. boom was installed near Eleventh Ave., and erected three bents of the framework of the engine room, forming two complete fully braced panels. A platform and track stringers were built on the central horizontal part of the top chords of the roof trusses, and on them a track was laid for a traveler with which all the remainder of the framework for this part of the building was erected from above, one panel at a time in advance. The traveler was built of timber and consisted substantially of a horizontal platform with an A-frame in the vertical transverse plane through its forward sill, and a long boom pivoted to the center of the sill.

The erection of the boiler room steelwork was commenced at the east end by three 15-ton guyed derricks, but after the completion of the first 200-ft. section, two of them were discontinued for this purpose and the remainder of the steel was erected by a single one, which was moved along on the center line of the room on the girders at the level of the bottom of the coal pockets. This derrick had a reach and capacity sufficient to erect four sub-panels of the structure in advance of its own base and handled the heaviest columns and girders and set the roof trusses complete.

The structural steel was delivered on lighters and unloaded by their derricks on cars at the river end of the building which were drawn to the required positions by a wire cable operated by a donkey engine which, like the hoisting engines for the derricks and traveler, was of the Lidgerwood make. Field rivets were driven by about eight gangs of men using Chicago Pneumatic Tool Co.'s hammers, drills and reamers (the latter two not often being required), operated by air from a Rand compressor. Erection was commenced in October, 1902, and was substantially completed in August, 1904. During most of this time an average force of about 75 men were employed by the erectors.

The structural work was designed and its construction and erection supervised by the engineering department of the Interborough Rapid Transit Co., Mr. S. L. F. Deyo, chief engineer of the subway division; Mr. J. Van Vleck, mechanical engineer; Mr. W. C. Phelps, assistant engineer in charge of all calculations and detail designs for the structural steel work, and Mr. G. E. Thomas, supervising engineer in charge of construction. The contract for the structural steel work was awarded to the American Bridge Co., and the Terry & Tench Co. was the subcontractor for the erection, of which Mr. W. J. Hundley was superintendent.



Derrick and Traveler on Engine-Room Roof and Coal Pockets.

Cooling Water Temperatures in Gas Engines.

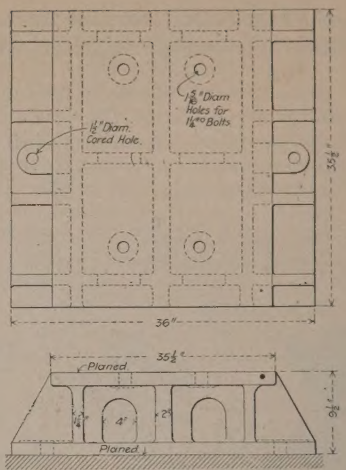
Internal-combustion engines have been the subject of a recent series of lectures by Mr. Dugald Clerk before the Society of Arts, London. In engines of moderate dimensions, having cylinders up to, say, 18 in. in diameter, it is found, he said, that the most economical results are obtained by keeping the temperature of the water jacket at about 80° C. (175° Fahr.). In such engines the temperature of the piston would be about 750° Fahr. Pistons up to 22 in. in diameter can be run without being water jacketed, he said, although they attained temperatures of 1,300° to 1,475°, and when one looked into the trunk, when such engines were running in a dark room, the back of the piston is seen to be at a dull red heat.

Types and Details of Bridge Construction: Plate Girders.—XIV.

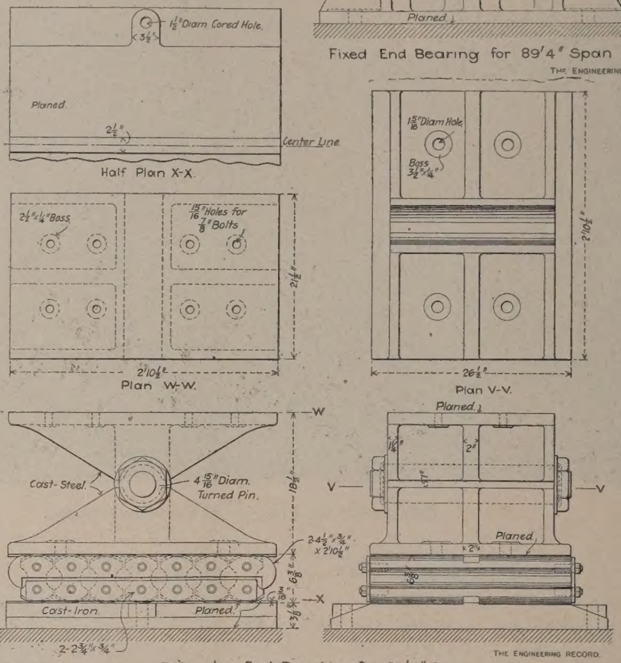
By Frank W. Skinner, C. E.

Miscellaneous End Bearings.—The transverse plate-girders of the Suburban Rapid Transit R. R. on Third Ave., north of the Harlem River, Borough of the Bronx, New York City, cantilever about 4 ft. beyond the columns, and are seated on the milled upper ends of the latter, and are connected to them by field-rivets through vertical connection angles on their webs and pairs of jaw plates shop-riveted to the column flanges and projecting nearly 2 ft. above them. The fixed ends of the 48-in. longitudinal girders have full-depth field-riveted web-connections to the transverse girders. At every fourth bent the south ends of the longitudinal girders have expansion bearings in pockets shop-riveted to the vertical web-stiffener angles of the transverse girders. These pockets are made with vertical side plates connected by vertical transverse diaphragm channels with horizontal shelf angles riveted to both sides at the upper edge to form seats for the lower flanges of the longitudinal girders, which are not bolted to or guided on them. The longitudinal expansion girders are held in place by horizontal longitudinal bolts through their end vertical flange angles and through corresponding angles on the fixed end girders and through the webs of the transverse girders. These bolts have check nuts or collars engaging the transverse girder webs and are long enough to project an inch or two through the flanges of the expansion girders and give clearance between them and their nuts for temperature expansion movements.

Standard short-span girder bridges on the Canadian Pacific R. R. have bearings at both ends on shoe-plates riveted to the lower flange angles and seated on steel bed-plates bolted to the masonry with single 1½-in. anchor bolts 38 in. long set with thin pure cement grout poured into the 1¾ in. holes before the bolts are inserted. For a clear span of 30 ft. the girders are 33 ft. long, 36½ in. deep, and 15 in. wide, with sole-plates 20¾ in. wide, 15 in. long and 1¼ in. thick. They are made from 1½-in. plates planed on the under side to leave a 1⅜x¼-in. center longitudinal rib fitting a corresponding 1⅝x⅛-in. groove planed in the bed-plate of the same dimensions. The bed-plates are riveted eccentrically to the girder flanges to project 2 in. farther beyond the outer than the inner edge, and have there one anchor bolt hole 2 in. in diameter for the fixed ends and slotted 2x4 in. in the expansion ends. The bed-plates are faced on the upper surface only and have corresponding 2-in. bolt holes. They are seated on 15x⅛x22¾-in. sheets of soft lead.

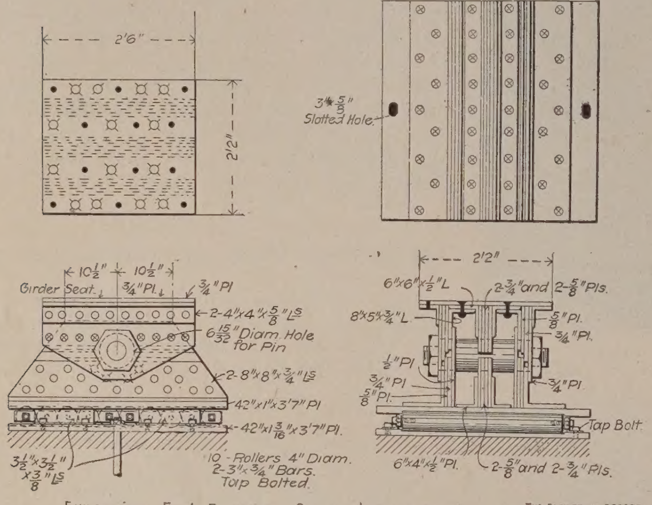


Fixed End Bearing for 89'4" Span



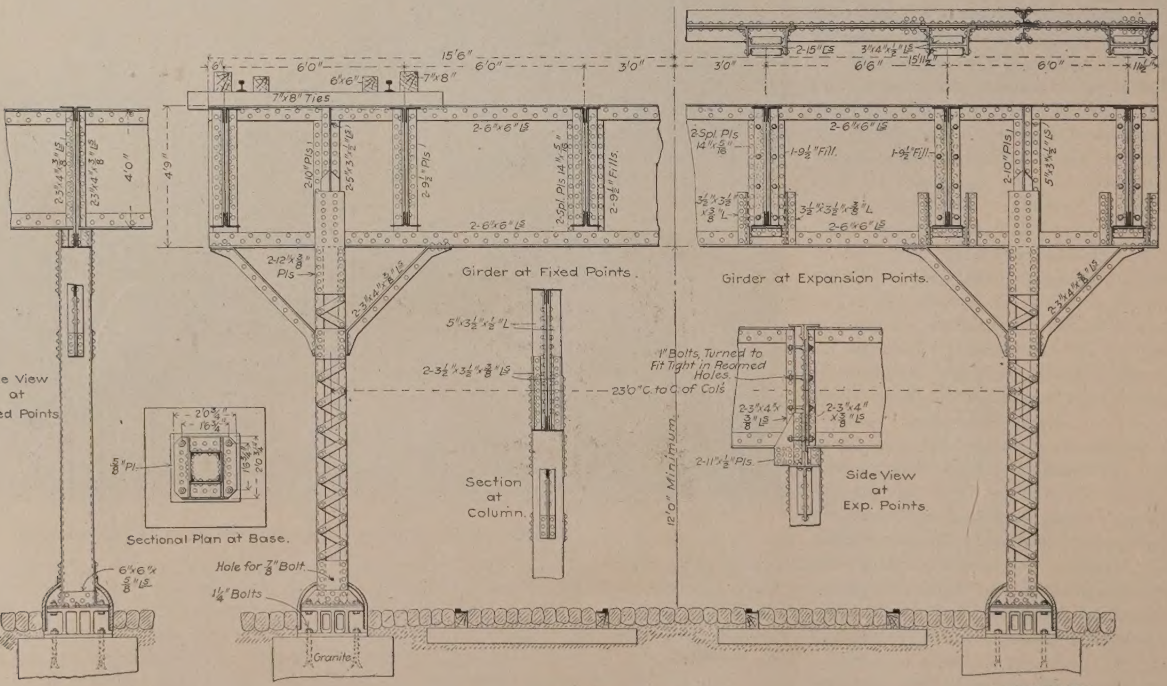
Expansion End Bearing for 89'4" Span.

Lebanon Valley Bridge, Philadelphia & Reading R. R.



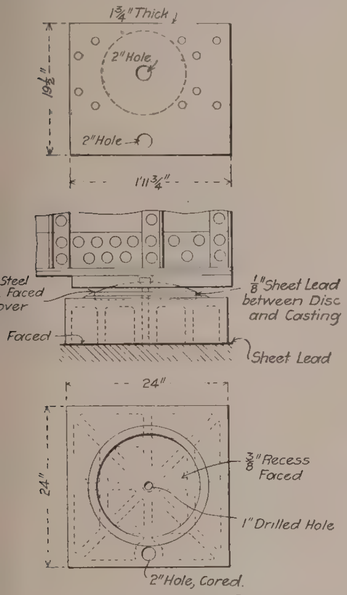
Expansion End Bearing for 102½-Foot Span.

C. C. C. & St. L. R. R. Bridge at Worden, Ill.



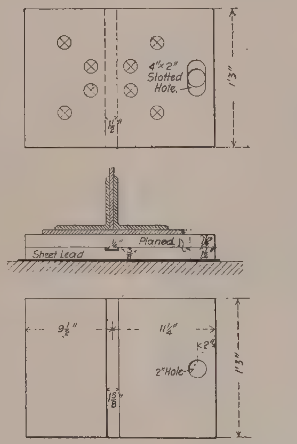
Suburban Rapid Transit R. R., New York.

Long-span plate-girders of the latest stand-d design for the Canadian Pacific R. R. have herical bearings at both ends to provide for flection, distortion and any irregularities of nstruction or substructure and to give perfect d uniform reactions under all conditions. For 60-ft. clear span the girders are 15 in. wide, in. deep and 65 ft. 4 in. long over all, and ve bearings 63 ft. 1 in. apart on centers. At ch end a 1¾-in. rolled steel sole-plate 23¾ in. ide and 19½ in. long is riveted eccentrically to e lower flange cover-plate, being flush with the ner edge and projecting 10¼ in. beyond the ter edge to engage a single anchor bolt clear the flange angle and cover-plate.



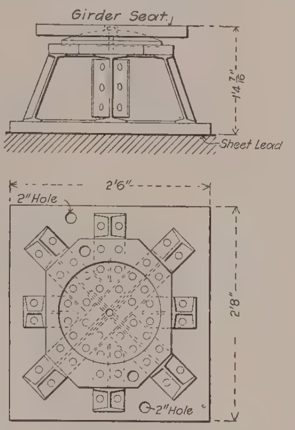
Fixed End Bearing for 60-Foot Half Deck Span

The Engineering Record



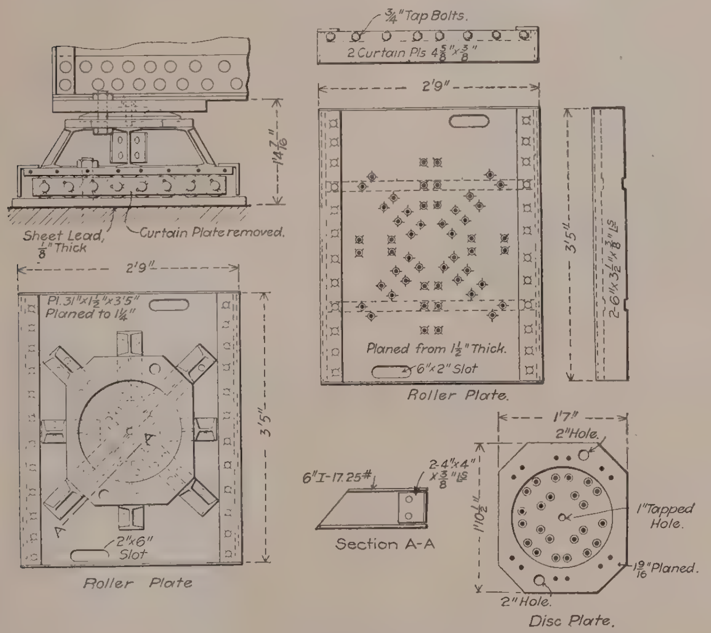
Slotted End Bearing for 30-Ft. Single Track Span.

The Engineering Record



Fixed End Bearing for 100-Foot Through Span

The Engineering Record



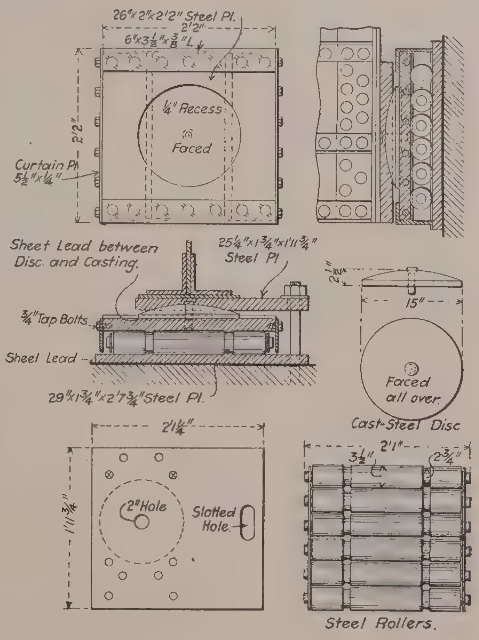
Roller Plate

Roller Plate.

Section A-A

Disc Plate.

Expansion Bearing for 100-Foot Through Span.



Expansion End Bearing for 60-Foot Half Deck Span.

The Engineering Record.

Canadian Pacific R. R. Standard Bearings.

Symmetrically with the girder web the plate bored 1 in. deep on the under side to fit the onvex surface of a horizontal cast-steel disk 15 in diameter, with the upper surface turned to spherical segment with a radius of 19⅝ in. It 2½ in. thick in the center and about 1 in. thick the edges. The flat under surface of the seg-ent is seated on a 14¾-in. disk of sheet lead ⅛ thick, set in a hole 15⅛ in. in diameter and ¼ deep in the top of a casting or plate, to which e disk is secured by a vertical 1-in. center rivet ith a countersunk lower head and an upper head which has clearance in a 2-in. hole in the sole-plate. When the girder is seated on the disk there is a clearance of 1¼ in. between the sole-plate and the disk plate, sufficient for any deflection.

At the expansion end the disk is seated on a rolled-steel plate 2 in. thick, with the under side planed to 1¾ in. thick, leaving two ⅞x¼-in. longitudinal ribs which engage grooves in the six 3½-in. rollers. The rollers are set on a base-plate corresponding to the upper plate, but projecting 5¾ in. beyond its outer edge to receive a single 1½-in. anchor bolt clear of the roller nest and upper roller-bearing plate which engages a slotted hole 4½ in. long in the sole-plate. The bed-plate is seated on a 31x⅛x34-in. piece of sheet lead. The space between the upper and lower roller bearing plates is enclosed by vertical dust-guard pieces to prevent the accumulation of dirt or rubbish around the rollers. These are made with two angles riveted across the front and rear ends of the top plate parallel with the rollers, and with two thin longitudinal vertical plates tap-bolted to the edges of the top plates, all of them having their lower edges planed to a clearance of 1-16 in. with the base-plate.

At the fixed end the masonry seat is at the same level as at the expansion end, and the omission of the rollers is compensated for by a cast-iron pedestal 6¾ in. high, which receives the disk and replaces rollers, roller bearing and bed-plate. The casting has longitudinal transverse and diagonal vertical webs, and is secured to the masonry by a single 1½-in. anchor bolt, which also engages the sole-plate.

For a 100-ft. clear span the girders are 8½ ft. deep, 19 in. wide and 105 ft. 10½ in. long, with bearings 103 ft. 1½ in. apart. The bearings are of the same type as those described for the 60-ft. span, with which the details correspond, except that each has two anchor bolts and that the disks are seated on riveted-steel pedestals. The pedestals have thick horizontal top and bottom plates connected by eight longitudinal transverse and diagonal I-beam webs. The disk is tap-bolted to the top plate in which it is seated, and the I-beam webs are connected at the center by short vertical angles. The sole-plate and the pedestal cap-plate are connected by two 1½-in. vertical bolts, and the I-beams are 6 in. deep. At the expansion end the base-plate of the pedestal has two slotted holes 6 in. long for the anchor bolts. At the fixed end the I-beams are 10 in. deep to compensate for the omission of the 3½-in. rollers, and there are 2-in. round holes for the anchor bolts, and the 35x1½x42-in. bed-plate is omitted and the pedestal is seated directly on the 32x⅛x34-in. piece of sheet lead.

The two double-track 105-ft. through girders of the Cleveland, Cincinnati, Chicago & St. Louis R. R. bridge across the track of the Wabash R. R. at Worden, Ill., have bearings on 6 7-16-in. pins, which engage triple-web pedestals and corresponding shoes riveted to 26x¾x30-in. base-plates on the girder flanges. The shoes are alike at both ends and have half holes in the center bearings and full holes in the outside plates of the outside webs. The three webs are reinforced to give a combined length of 9 in. of pin-bearing and are secured to the base-plate with 4x4, 6x6 and 5x8-in. angles. The horizontal flanges of the inside and outside web angles are superimposed on each other.

The pedestals correspond to the web shoes except that they have larger base-plates and that the outside webs have only single connection angles, the inside angles being omitted. The web-plates are exactly opposite those of the shoes and match them, the outside plates only of the outer webs having full pin-holes, and thus locking the shoe and pedestal together with a clearance of ⅜ in. each side of the pin center. This arrangement reduces the pin stresses to direct compression and eliminates both shear and bending. The 42x1¾x43-in. base-plate is planed to a thickness of 1 in. for the full length and for a width of 16 1-16 in.

each side of the center line. This gives an upper bearing for the ten 4-in. rollers 32 in. long between necks, and provides outside longitudinal fins which engage their square ends, retain them in position, and take up transverse stresses without the necessity of the usual center rib and grooves.

The rollers are plain cylinders 4⅛ in. apart on centers, secured to 3x3¾-in. side strips. The two center and two end rollers have square ends with shouldered tap bolts connecting them to the side strips, the intermediate roller necks 1 in. in diameter engaging holes in the side strips. The rollers are seated on a 42x43-in. rolled-steel bed-plate planed out with side ribs to correspond with the pedestal base, and having short side angles tap-bolted to it to engage the roller frame between the tap bolts. The roller shoes have two slotted holes 3 in. long through the base-plate outside the roller bearings, to receive the 1½-in. anchor bolts passing through round holes in the bed-plates. The fixed end pedestals are exactly like the roller pedestals, except that the under sides of their base-plates are not planed and that they have round holes for the anchor bolts. They are seated on plain 42x1x43-in. bed-plates and the difference in the heights of the bearings due to the omission of the roller nests is made up by building the masonry seats 4 in. higher at this end of the bridge, so as to keep the girders level.

The double-track through plate-girder span of the Lebanon Valley crossing of the Reading Belt Branch of the Philadelphia & Reading R. R. has girders 83 ft. 9 in. long and 9 ft. 4½ in. deep over all, with 18-in. flange cover-plates. Sole-plates 32x11-16x48 in. are riveted to the ends of the lower flange-plates and are stiffened by vertical transverse webs. These plates take bearing on concentric cast-steel shoes with 21½x34½-in. top-plates bolted to them. They have continuous half-hole bearings 21½ in. long, stiffened by three transverse webs, and engaging 4 15-16-in. pins seated in corresponding pedestals. The pins have shouldered ends threaded to fit chambered nuts, which, with the washers, lock the shoe and pedestal together.

The expansion end pedestals have longitudinal center ribs on the planed bases, which engage grooves in the centers of a nest of seven 6⅜-in. segmental rollers. Each roller is connected by a pair of tap bolts in each end to two side bars with ¾-in. clearances between the square ends of the lower ones and the hooked ends of the upper ones. This device limits the angular displacement of the rollers, which are seated on a 36x36½x3⅛-in. cast-iron bed-plate with the longitudinal edges beveled on the upper side and cored for two 1¼-in. anchor bolts which clear the rollers, shoe and pedestal and engage the sole-plate. At the fixed end the rollers and bed-plates are replaced by a cast-iron bolster having a height equal to their combined heights. It is made with planed top and bottom plates, three transverse and three longitudinal 1¼-in. vertical webs, and bracing ribs for the outside webs. It is anchored to the masonry by two bolts through 1½-in. cored holes, and is secured to the pedestal by four 1¼-in. bolts through drilled holes.

(To be continued.)

A Gas-Engine Railway Power Plant has been built at Garrett's Run, Pa., for the Kittanning & Leechburg Railway Co. It is housed in a buff brick building, 45x95 ft. in plan and 18 ft. in clear height to the roof trusses, and is designed to comprise four 500-h.p. gas engines. The type of gas engine installed is the three-cylinder vertical engine built by the Struthers-Wells Co., of Warren, Pa., with direct-connected 250-kw. generator. In the center of the building, in the basement, is a 20-h.p. gas engine, which furnishes power for the air compressors and water pump.

An Analysis of Power House Expenses.

A great deal has been written concerning the best system of auditing the accounts of a power station, yet the subject seems as unsettled as ever. For this reason attention is called to methods used at a copper smelting plant producing upwards of 1,000,000 lb. of refined copper per month. According to Mr. Percy E. Barbour, who explains the system in the "Journal" of the Worcester Polytechnic Institute, it was considered necessary to segregate the power house expense very carefully and according to some constant formula, so that the differences in the monthly detail cost sheets will represent variations in cost, and not in method of calculation. When it is considered that the cost of bessemerizing steel is only a fraction of a cent per pound, and that there are not less than fourteen items which go to make up this one expense, it will be apparent that figuring costs to the fourth decimal place is not an excess of refinement but a detail necessary to good organization in manufacture. This distribution, while to a certain extent of a clerical nature, is really, as will appear by the method of calculation, mechanical; and in fact it is done in the mechanical department and is signed by the mechanical engineer.

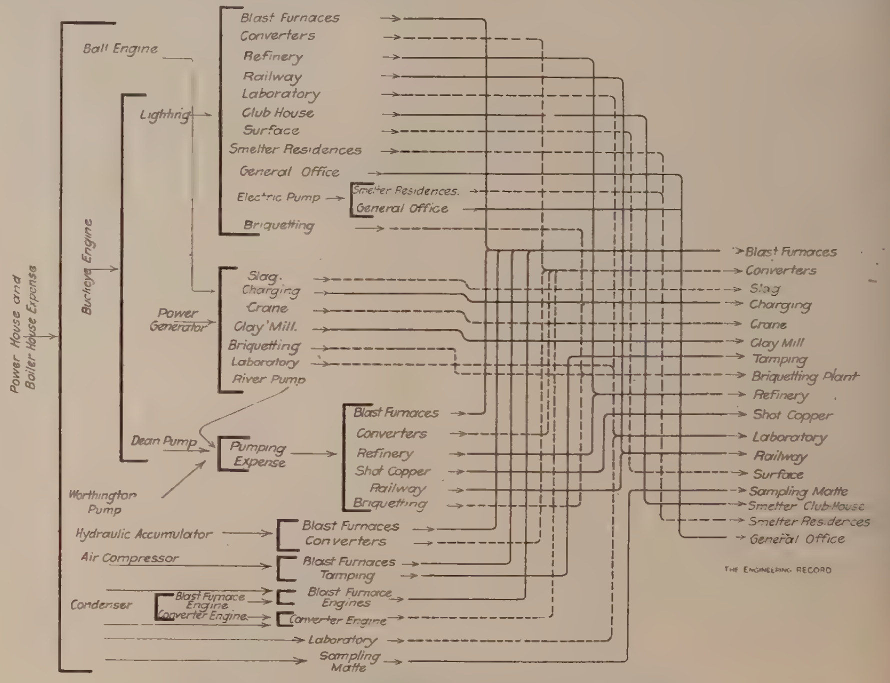


Diagram Showing Distribution of Power House Expenses.

An enumeration of the power units will aid the subsequent description. There are three Nordberg horizontal cross compound blowing engines 13x24x42-in. and two air cylinders 57x42 in. for furnishing air to the blast furnaces, and one similar engine 15x30x42-in. and two air cylinders 40x42-in. for furnishing air to the bessemer converters. The electric power for driving the locomotives, etc., and for lighting is furnished by a Buckeye engine 16½x27 in. Both generators are belted from the main flywheel. A Ball engine with direct connected 110-kw. generator is held in reserve to the Buckeye. This Buckeye also drives by belt and clutch pulley a Deane triplex power pump for general service work about the smelter. A steam driven duplex pump serves the hydraulic accumulator. A Root rotary pump brings fresh water for the boilers from the river one-quarter of a mile distant to a storage tank at the power house. This pump is also connected by the necessary piping to deliver water to the circulating supply for the blast furnace water jackets, which latter are ordinarily served by a Worthington duplex steam-driven pump. The boiler feed pumps are not itemized, but are included in the item "Boiler House Expense." A Norwalk air compressor furnishes air for the pneumatic tamping machine and the elevator run by a small winze hoist operated by air. The blowing engines only run condensing and are served by a 1,750-h.p. independent Conover condenser.

Labor and supplies make up the total of all charges, but are also carried as individual items throughout.

The regular form which comes to the mechanical engineer monthly shows the total amounts charged to boiler house expense and to power house expense for labor and supplies, and these are the amounts which require the most segregation. In addition, there are so-called direct charges to the individual units for labor and supplies expended especially on each. This form is shown in the accompanying diagram.

Distribution of Power House Expenses for 1 Month.

	Steam.	Labor.	Supplies.	Total.
Blast furnace engines	5,200,970 lb.	$408.52	$923.09	$1,331.61
Converter engine	1,864,518 lb.	146.45	330.92	477.37
Condenser	937,440 lb.	73.64	166.38	240.02
Buckeye Ball	3,591,000 lb.	282.06	637.35	919.41
Hydraulic pump	273,430 lb.	21.48	48.53	70.01
Worthington pump	180,180 lb.	14.15	31.98	46.13
Air compressor	1,290,300 lb.	101.35	229.01	330.36
Laboratory	30,000 lb.	2.36	5.32	7.68
Sampling matter	20,000 lb.	1.57	3.55	5.12
Total	13,387,838 lb.	$1,051.58	$2,376.13	$3,427.71

Careful tests have determined the steam consumption of each unit either per revolution or per hour as was necessitated by the conditions of operation. The power house daily report shows either the revolutions made as recorded by continuous counters or the number of hours run by the various machines. The total steam consumption for the month is calculated by units by means of these data.

In addition to the apparatus enumerated as eam using, an arbitrary amount of steam used a small engine running a crusher on the bins charged to sampling matter, and another fixed nount to laboratory, this being used in the ating coils in the dryer. Having found the eam consumption of each unit and the total eam consumption, a simple problem in division ves us the percentage each is of the whole, and is percentage we use as a factor to determine e dollars and cents charged to the individual nits. The cost items to which we apply this rmula are the first two in the schedule, namely, e boiler house expense plus the power house xpense, they representing the cost of labor, coal, il, supplies, etc., used in the generation and conumption of steam.

$$\frac{\text{Steam for unit } x}{\text{Total steam consumption}} = \frac{\text{Labor charged to } x}{\text{Total labor cost}} = \frac{\text{Cost of supplies chargeable to } x}{\text{Total cost of supplies.}}$$

The figures in the table, from a recent month's osts, will serve as an illustration.

This table gives us the cost of steam for the ifferent units and our original sheet gave us the irect charges to the different units. We comine these for each unit and segregate as follows:

The total charged to the Buckeye will consist f charges for steam and direct charges for speial labor and supplies on the Buckeye alone. This engine runs the Deane pump, and the amount f steam required to run it alone has been estabished by test. As its steam consumption is to that of the Buckeye so is its share of the steam cost to the total cost of Buckeye steam ,and this amount we charge to pumping, to be taken up later. The remainder of the Buckeye expense is divided between power and light in proportion to the size of the respective generators.

Now the expense for electric power is charged to all departments using this power, viz.: Slag locomotives, charge floor locomotives, electric crane, clay mill, briquetting plant, river pump, and motors at laboratory by a percentage determined by wattmeter readings or calculation, the sum of all being 100 per cent. The expense for light is similarly divided among all departments using light, the direct charges for electric lighting expense first having been added.

The pumping expense is the total of direct charges, cost of steam for the Worthington and Deane pumps, and electric power for the river pump. This expense is apportioned by a percentage determined by experiment or calculation, to the various departments using water, viz.: blast furnaces, converters, refinery railway, shot copper, briquetting. Of this 80 per cent. is generally chargeable to the blast furnaces, which use each about 350 gal. per minute.

The hydraulic pump, so-called, serves the hydraulic accumulator which furnishes a constant hydraulic pressure to operate the mechanism for rotating the converter shells in their stands and for raising the charging doors on the furnaces. This expense is composed of an item for steam and one for direct charges, and is chargeable in part to blast furnaces and in part to converters.

The condenser expense is divided between the blast furnace and converter engines in proportion to the amount of steam each furnishes to be condensed. The air compressor expense is divided between the blast furnaces and converters rather arbitrarily, but in proportion as nearly as can be determined to the number of hours the hoist and the tamping machine each runs.

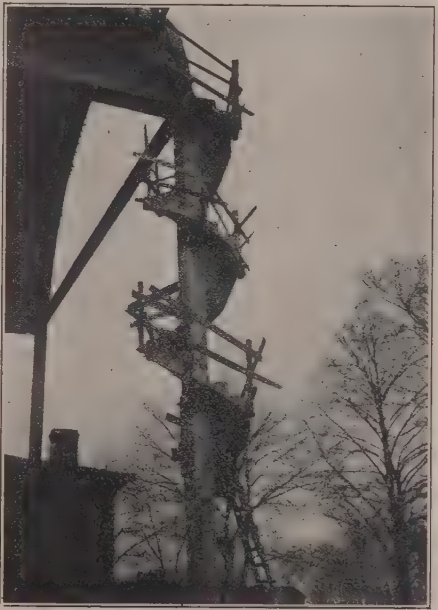
Blast furnace engine and converter engine each has charges, direct, for steam and for condenser. Our distribution then only remains to be summarized, and we have the distribution as given on the blank form which itemizes all the various power house expenses.

With a cost sheet like this before us, and the production of copper in pounds, the cost of each item per pound of copper is figured. With these data, costs can be so closely scrutinized that an advance of 0.01 cent per pound in the cost of copper can be quickly traced to its cause. The value of such a system can be readily appreciated. It is indispensable to profit-making in a low grade smelting proposition, where the cost of production is necessarily high, and this is especially so when the price of copper is low.

If the final results are plotted on co-ordinate paper, analysis by inspection will give information covering long periods of time.

A Bold Stairway of Reinforced Concrete.

One of the most interesting buildings of reinforced concrete now being put up is the chapel at the United States Naval Academy at Annapolis. This structure, which was designed by Mr. Ernest Flagg, of New York, was described in this journal on Jan. 14 of this year. The framework, dome and arches are of reinforced concrete, while the walls are of granite and white brick on the outside and Caen stone inside. The columns and dome are covered with terra cotta. There are four arches over the ends of the transepts. These arches are independent of the massive ring upholding the dome, and are supported at their outer corners by slender columns, and one of these columns carries the winding stairway which is illustrated.



Reinforced Concrete Stairs.

Such stairways have been used to a considerable extent in French construction of this class, but probably never before in this country. Inasmuch as the chapel is being erected by the Baltimore Ferro-Concrete Co., which has a large staff of French specialists in reinforced concrete, it is not surprising that they employed the system in this case. The seeming boldness of the design cannot ordinarily be shown in a photograph, but fortunately it was possible to secure a view of this work before it was encased by the walls of the building. In the completed structure access to the bottom of the stairway will be afforded by a platform reached by straight flights from the ground level, as shown in the illustrations in the article mentioned above.

A Surface Condenser in which the lower rows of tubes are submerged in the water of condensation has shown a gain in the degree of vacuum obtained, according to Mr. R. W. Allen, of Bedford, England, in a paper on surface condensing plants read at the Institution of Civil Engineers.

The Fremont Method of Determining the Fragility of Iron and Steel.

The general interest in impact tests of iron and steel has been a noticeable feature of engineering research for a number of years. Among those who have paid most attention to this method of testing is M. Fremont, who has devised a new machine and a new system of testing, which have aroused much discussion in Europe. Little information concerning his work has been printed in the United States, however, and for this reason a paper on the subject, recently read before the Engineers' Club, of Philadelphia, is a timely one. It was prepared by Mr. Thorsten Y. Olsen, superintendent of Tinius Olsen & Co. of that city who manufacture the Fremont machine in this country. Mr. Olsen has summarized in his paper, which is given in the Club's "Proceedings" of January, the information given in various contributions to the journal of the Society for the Encouragement of the National Industry of France by M. Fremont, and also much data given by the latter to the author personally.

The principles on which the machine depends are explained by Mr. Olsen as follows:

Take two steels which have given approximately the same diagram by the tension test; call these two steels No. 9 and No. 16 as in Fig. 1. Subject this same material to a bending test. The second set of curves, Fig. 2, were obtained from these two steels tested both with the rolling and at right angles to it. These curves show that in both cases No. 16 broke with a greater amount of work than No. 9, although the reverse was shown by the test of tension. Then, again, Fig. 3 is a bending diagram of a steel which gave a similar tension diagram. This, as can readily be seen, gives a far better bending test than either of the other two steels.

Take a soft steel, placing a notch at its under side to reduce the elongation, then polish one side and submit it to a partial bending. The deformations are easily seen in Fig. 4, and consist of the interposition of two elementary deformations. One deformation is that of swelling; the other, that of depression.

The depression E F G B H is nearly an ellipse, of which the major axis coincides with the line A B joining the point of impact to the notch. The swelling is a portion of the ellipse having the same major axis as the preceding, but the extremities of the major axis do not coincide. The two ellipses have the part A G B H in common, and thus the two deformations are in part neutralized. The other portion of the ellipse produces the maximum deformations, and the rupture takes place along the synclinal lines G F and H E.

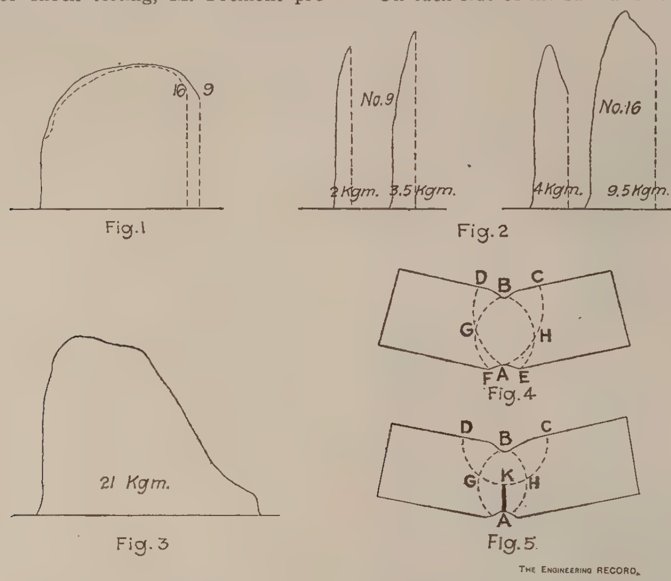
Take now the case of a fragile steel, shown by Fig. 5. In this case the ellipse caused by the compression or the swelling is reduced to nearly nothing. The rupture is made downward by tension following the line A K in the diagram, and the rupture is effected abruptly with a very small expense of work. For steels of intermediate quality, the two ellipses will vary from the one extreme to the other.

The rupture of these steels depends upon the position of the point K of the ellipse of compression. If the point K goes to A, the metal will not be weak, while if the point K rests in the neighborhood of point B, the metal will be extremely weak. Thus, both the prominence of the swelling and the position of the point K are important factors in this determination of the fragility of a specimen.

In tension testing, the speed is a more or less important factor, depending on the ductility of the steel, and it is well known that an increase of speed increases the resistance of the metal, but decreases the elongation.

By comparing tests effected by rupturing specimens by a repetition of blows and by a single blow M. Fremont found that some steels ruptured by a single blow required but one-third to one-fourth the amount of work required by the repeated blows, and thus impact testing employing a repetition of blows is little better than a bending test. Steels appearing non-fragile by the first method would appear fragile when subjected to a single drop of a hammer just sufficient to break the bar.

As the shock test varies with the speed of impact and the deformations become smaller, the fragility slightly shown in the bending test will appear in its true form in the impact test. The rate of molecular transmission of force through a steel may be one way of defining this fragility. It is also a fact that for the same steel this rate approaches a limit independent of the speed of impact when twice that sufficient to rupture the specimen.



Diagrams Illustrating the Fragility of Steel.

Knowing the desirability for an accurate and easy means for shock testing, M. Fremont presented a communication to the Academy of Science in 1897 proposing a method of registering the amount of work required to produce rupture by this means. As the speed of impact is a great factor, it is necessary to make the speed of the hammer sufficiently great to rupture the specimen with one blow, whatever the quality of the metal. To determine the amount of work absorbed to produce this rupture, it is necessary to measure the residual work that is possessed by the hammer after rupture of the specimen.

Table Showing Comparative Results of Different Tests.

Tension Test.		Static Bending.		Bending by Shock. Notched by a Saw.		Notched by a Milling Cutter.	
Tensile strength.	Elongation in 20 cm.	Lengthwise.	Crosswise.	Lengthwise.	Crosswise.	Lengthwise.	Crosswise.
kg.	%	kgm.	kgm.	kgm.	kgm.	kgm.	kgm.
47	24	9.5	8	13	6	10	6.5
60	25	4.5	2.5	4.5	4	6	6
44	28	12.5	10	6	6	6.5	4.5
37	30	22	20	9	7	1	7.5
33	25	12.5	2	9	3	3	2
33	32	21	20	5.5	3	4	3.5
45	27	5.5	6	3	4	5.5	4.75
60	22	15.5	4	7	3.5	6.75	3
50	20	5.5	12	7	5	6	4
40	23	22.5	17.5	22	13	21	19
53	23	4	3	5	2.5	5.2	3
49	27	20.5	6	22 19.5 21.5 21.5	5	24 21.5 21.5 24	4
46	27	25	12	30.5 29 29 26	17.5 18.5	26.5 26 30	16 17.5 17
43	28	22	19	24.5 25 25.5 30	22.5 19 21.5	22.5 23 24	19.5 23 23.5
50	26	24.5	6.5	20 22 22.5 23	5 5	22.5 22.5 21.5	4.5

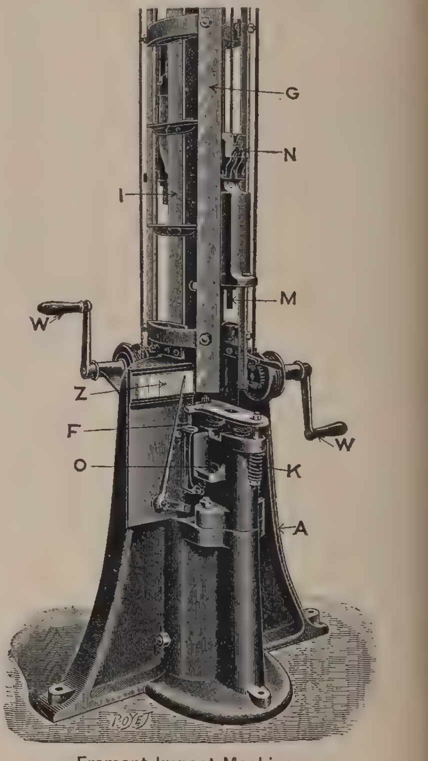
The machine as built to-day is shown in the accompanying cut, which represents the lower portion of the machine. The design is made double, so that two may operate on the same machine at the same time. The base of the machine is composed of two parts connected by bolts. Between them, and held tightly by them, is a central I-beam marked I. This carries six cast-iron supports, at intervals, to which are bolted the four rolled-steel guides marked G. Two anvils are bolted on opposite sides of the base, the whole weighing more than 1500 lb. The weights of the hammers are 20 and 30 lb. The anvils marked A contain in front and in back of the matrix vertical cylindrical holes serving for the lodgment of two springs. A cap of hard steel is placed directly over them. It is this cap or platform which receives the hammer after the rupture of the specimen.

The hammer compresses the springs, and the space traversed by them is then measured. As the springs rebound after the blow, it violently repells the cap, and so to offset this new shock the cap is held by two small springs, one of which is visible on the front of the anvil at K. These springs thus serve merely as a deadener to the cap when rebounding.

On each side of the base and to the right of the operator is a windlass marked W, by which the hammer is easily and quickly raised. A ratchet and lever prevent the downward motion of the hammer when placing the specimen in position. Each hammer has inserted at its lower extremity a hardened steel punching tool, M. A gripping device at N holds the hammer to the pulling cord until automatically released at the top of the machine.

To operate the machine the weight is raised enough to allow room to place the specimen in position, notch side down, with the notch directly in the center of the die. Then the weight is raised to the top, where it is automatically released, and, falling, breaks the specimen, which in turn falls through the die into the pocket at the side of the machine. Having broken the specimen, it is necessary to measure the work required to cause the rupture. The cap covering the springs pushes down a light steel tube at F, which is held by friction so as to give an accurate measurement of the deflection of the springs. This deflection is further multiplied by the aid of the instrument shown at Z.

To calibrate the machine the hammers are raised through successively increasing intervals of height and dropped on the platen covering the springs. Corresponding marks are placed on the card of the instrument, as shown. Thus, the machine can readily be calibrated at any time with about ten minutes' work.



Fremont Impact Machine.

The advantages of these tests are threefold: 1. The method, by using small specimens, reduces the cost of test pieces and their preparation, thereby furthering the great production of tests and thus aiding in establishing a standard homogeneity test. 2. The small specimen permits of testing thin plates, both with and across the rolling, as well as the possibility of testing parings, or clippings from actual material used, or those nearest to any section subjected to the greatest known stress. 3. The machine affords an accurate method of measuring the work necessary to produce rupture under standard conditions, always maintaining the same speed of impact.

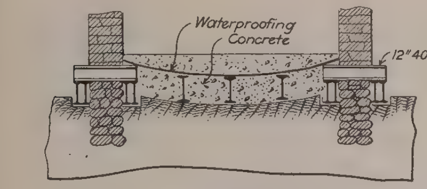
The machine as manufactured in this country will have a standard drop of 13 ft. with hammers weighing 20 and 30 lb., as these are the nearest English units to that used in the metric system. The specimen will be ⅜ in. wide, 5-16 in. thick, and 1¼ in. long, with a saw-cut 1-16 in. deep. The die is 13-16 in. wide. The machine can be shifted from the one standard to the other without any material change.

To determine the influence of the dimensions of the notch on the results of the tests M. Fremont made three series of tests; first, with depth equal to the width; second, width equal to twice the depth; third, depth equal to twice the width.

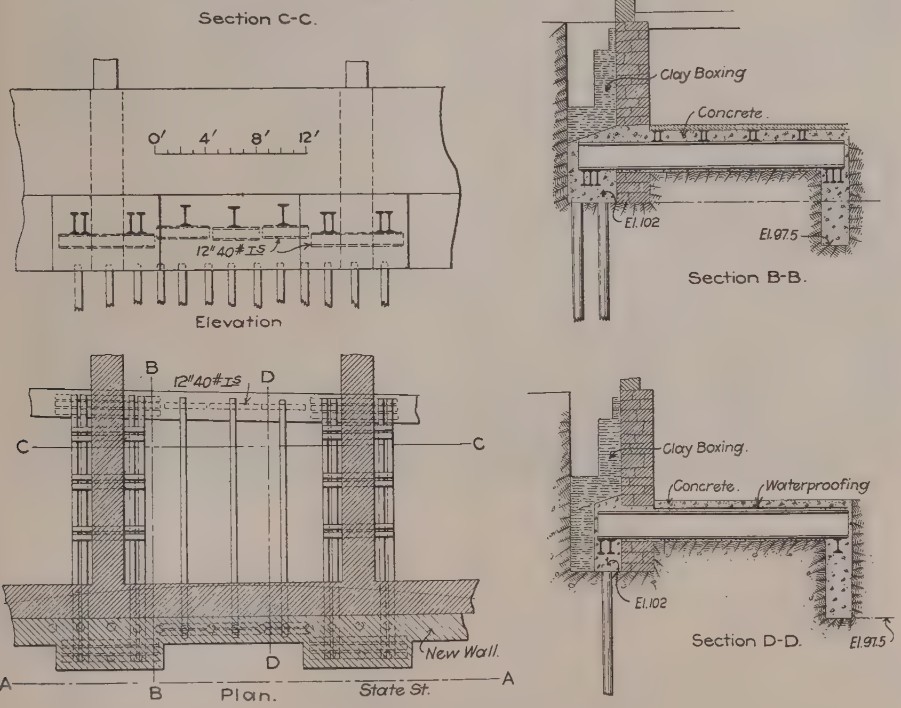
In the bending test he found that double the width required the same maximum force to commence the rupture, but required more work to complete it. Double the depth required less force to commence the rupture. Making these same tests by the drop of the hammer, he found that a small variation in width was not discernible, and only the case of double the depth created a difference in the results. The more fragile the steel, the less important would be a small variation in the size of the notch. Some results obtained by the Fremont drop test, compared with other forms of testing, are shown in the accompanying table. Beginning from the left, it gives the results of the tension test, bending test, and shock test, with notch made both with a hacksaw and with a milling cutter. These tests show that the drop test reveals fragility much better than tension and bending tests.

Underpinning the Sears Building, Boston.

The eight-story Sears building, on Court Street, Boston, is so near the line of section F of the East Boston tunnel that the side wall of the latter projects under the front wall of the building, and it became advisable to carry the footings of the building down to footings of the tunnel and build the new foundation walls in contact with the tunnel side walls. As it was necessary to do this without vacating any part of the building or interfering with the tenants a special method of supporting and underpinning the wall was devised and executed.



Section C-C.



Elevation

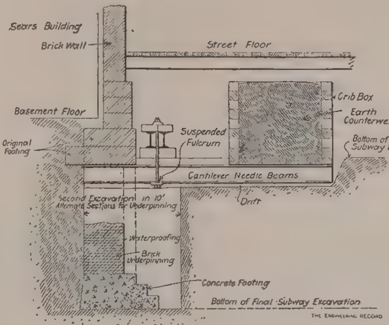
Plan.

Section B-B.

Section D-D.

Permanent Steel Beams in Underpinning.

The tunnel excavation in the street was carried down nearly to the bottom of the old footings, and was covered by a wooden deck, on which traffic was maintained. Transverse drifts wide and deep enough to take three or four I-beams were then made at short intervals under the old footings, and in them were placed groups of steel I-beams about 20 ft. long, reaching from the inner face of the footing to about the center of the tunnel excavation, in shallow trenches in the bottom of the latter. They were suspended close to the outer face of the footing by vertical screw bolts from longitudinal I-beams supported on blocking on the trench bottom. Crib-work boxes were placed on the extremities of the transverse beams and filled with earth. The footings were carefully wedged on the beams and the bolts were screwed up to solid bearings. Pits about 10 ft. long, 8 ft. wide, 15 ft. deep and 10 ft. apart in the clear were then made under the wall which remained supported above them on the counterweighted, suspended cantilever needlebeams, while new concrete footings and brick underpinning were built up to relieve them, after which the intervening cores were taken out and the underpinning completed. The remainder of the excavation for the tunnel structure was then carried down to sub-grade and the walls, invert and roof constructed in the usual way, a 15-in. pipe sewer which was encountered, being maintained in service until a new sewer, built in the foot of the sidewalk, and reinforced with short vertical and horizontal twisted steel rods, as shown in the cross section, was completed. The underpinning was executed without shoring or entering the building or obstructing the street traffic.



In the adjacent section C of the tunnel its bottom is 25 ft. below, and in some places not more than 3 ft. horizontally from the footings of a number of four-story brick buildings on State St., between Commercial St. and Chatham Row. To insure these buildings against settlement or displacement their front and portions of their transverse walls were supported on permanent steel beams without extending the original footings to any greater depths. Before the tunnel excavation was commenced, trenches about 4 ft. wide and 12 ft. deep were dug to the bottoms of the footings and adjacent to their street faces, and in the bottom of the trench a row of piles was driven to below the level of the tunnel subgrade. A concrete wall was built on the pile tops, filling the full width of the trench to a depth of about 2 ft., and on it were set, close together, pairs of short 12-in. longitudinal I-beams. About 15 ft. away, in the clear, a trench parallel to this wall was dug about 2 ft. wide and 10 ft. deep below the cellar floor, inside the building. It was filled with concrete to a depth of about 6 ft., on which were set longitudinal I-beams parallel to and at the same level as those on the outside wall. Holes about 4 ft. apart in the clear were made in the front wall, and through them were placed 18 to 24-in. steel I-beam needle-beams 18 to 21 ft. long. Shallow trenches were dug for them in the cellar floor and their ends were supported on the longitudinal I-beams. The walls were wedged up to solid bearing on the needle-beams, the openings around them securely closed, and the beams were entirely surrounded by concrete which was carried up to the cellar floor, and was waterproofed by a six-ply layer of tarred felt, mopped with roofing pitch and embedded in the concrete 12 in. below the upper surface. In some places the transverse beams were arranged at slightly different levels, so that the cross section of the concrete enclosing and connecting them formed an invert calculated to resist upward pressure. The transverse walls were carried on short needle-beams resting on the top flanges of double main needle-beams for the front wall laid close to the faces of the transverse walls.

This work was done subject to the approval and inspection of the Boston Transit Commission, Mr. Howard A. Carson, chief engineer. Coleman Brothers and the John Cavanagh Building & Moving Company were the contractors who executed work described for the Sears building and on State St., respectively.

Wood Stave Pipe Line in Pennsylvania.

Wood stave water pipes seem to be steadily growing in favor in the Eastern States, where it was generally held at one time that their use in the West was mainly due to the high cost of iron and steel mains when in place in that section of the country. It is now known that wood pipe may be economical, even in the heart of the Pennsylvania iron district. At Johnstown, for example, a 6½-mile main from 36 to 44 in. in diameter proved a successful solution of a troublesome problem, which Mr. John Birkinbine recently described before the Engineers' Club, of Philadelphia.

The conduit had to be laid along the Little Conemaugh River, where there is no wagon road at most places, the creek and the Pennsylvania R. R. occupying the limited space between the steep hillsides. To handle cast-iron pipes weighing 3 to 4 tons apiece and joint them in such a locality would have been costly. Riveted steel pipe did not seem desirable in view of the light head and the occasional acidity of the water, which is used for neither domestic nor boiler purposes. Wood-stave pipes, laid by Mr. C. P. Allen, of Denver, proved most economical. They were made of Washington fir staves 1½ to 1⅝ in. thick and banded with ½-in. round rods spaced according to the Allen formula, in which the number of bands per 100 ft. is 600 D P H F ÷ A B, D being the diameter in inches of the pipe, B the breaking strain of a band, F the factor of safety, A the area of the section of a band in square inches, H the head in feet, and P the pressure of 1 ft. of water.

Steel Work in the New York Hippodrome.

The Hippodrome, on Sixth Avenue, between 43d and 44th Sts., New York, is a large fireproof building which contains many novel features in construction and equipment and is designed to be used exclusively for amusement purposes, principally those associated with circus, menagerie and aquatic exhibitions and the like. The main auditorium has both stage, arena and circus rings, and there is liberal provision for restaurant and café accommodations intended to make it both a winter circus and all-year resort. The building is over 200x226 ft. in size, and 100 ft. high, and has, in the rear and sides, self-supporting brick walls which carry the ends of the floor beams. The front wall is carried by the columns and has elaborate façades and towers. The floors and roof have steel trusses and girders, supported on interior steel columns made with pairs of channels and cover plates, or with a web and two flanges. The main interior walls are of brick, and the minor partitions are of hollow tile. The roof and floor slabs are of the Roebling concrete arch construction.

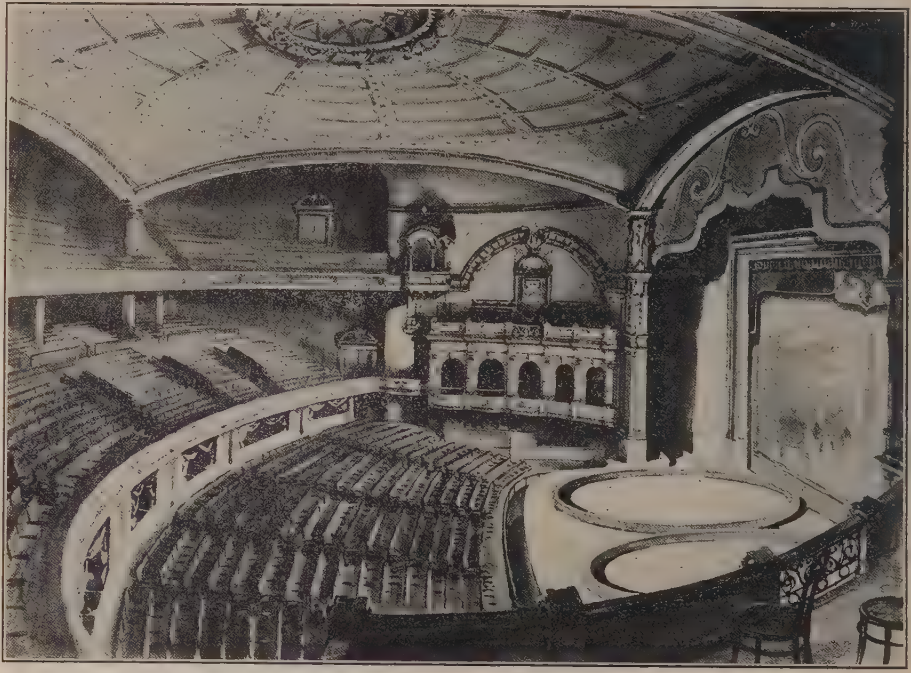
The floors are proportioned for total live and dead loads of 150 lb. per sq. ft. and are covered with a wearing surface of terrazzo or cement carpeted, except in the auditorium, where it is of fireproofed wood, and the entrances, where it is of rubber tiling. All the interior trim is of kalemeined or fireproofed wood, all steel work is covered with metallic lath and cement plaster or is protected by the concrete construction. The side windows are of wire glass and the stage has 1,400 sq. ft. of surface in four large double-pitched skylights with inclined sides connected at the peak by fusible links, which in case of fire will melt at 200 degrees and allow the frame to automatically slide down on rollers and provide vent openings as required by law. Six 4-in. stand pipes are supplied from a 30,000-gal. storage tank on the roof and have fire hose on every floor, besides which there are automatic sprinkler systems installed on the stage and in nearly all parts of the building except in the cafés and auditorium. The stage and dressing-rooms are separated from the rest of the building by a thick brick fire wall and an automatic asbestos fireproof curtain.

The auditorium is about 160 ft. long and 160 ft. wide in the first story, and the balcony and gallery occupy all the building in front of the stage, above the first story. The arena is at street level at the foot of the auditorium inclined floor. The remainder of this floor is occupied chiefly by the restaurants, cafés, wine rooms, smoking rooms, corridors, lobbies and entrances and by a row of boxes between the promenade and the arena. The main seating capacity of the auditorium is in the balcony, which has a width of about 50 ft., a seating capacity of about 1,600 and is fitted with boxes at both ends and the front. The curved end walls of the balcony are about 12 ft. inside of the outer walls of the building and the space below the side boxes provides for separate passageways from the arena, inclined downwards to the basement for the entrance and exit of chariots and animals. Between these walls and the outer walls of the building there are spaces on each side from 16 to 24 ft. wide, which are continuous with the stage space, and enclosed with thick fireproof brick walls separating them effectually from the auditorium and other public portions of the building. This somewhat reduces the space usually available in such a building for seats, but eliminates the undesirable locations and leaves only seats with an unobstructed direct view of the arena and stage beyond it.

The dressing-rooms are located in the two rear corners of the stage, and separated from it by a brick wall 2 ft. thick, and the only communication between the dressing-rooms and the stage is on the first story, by an opening provided with double fire doors.

At the rear of the balcony is the mezzanine floor, and below the rear seats of the balcony there is a wide segmental promenade with main entrances and flights of wide shallow stairs at each end to the street, and behind the promenade the space 50 to 70 ft. wide and 200 ft. long is occupied by smoking-rooms, parlors, waiting-rooms and cloak rooms. The U-shape gallery seats about 1,400 and separate small galleries are continued from the ends to the stage for musicians' quarters. Under the main orchestra floor there is a large plenum chamber from which the hot air is distributed through the auditorium by registers under the floor seats. The remainder of the basement story in the auditorium part of the building is occupied by the tank pit, under the arena, the inclined passageways from the arena; horse stalls; elephants' quarters; steam, hydraulic, electric and heating plant; feed and storage rooms; toilet rooms; kitchen and pantry.

A special feature in the auditorium is the arrangement and construction of cages for animals of the feline kinds. Their cages are arranged in a segmental curve in the promenade at the rear of the main auditorium, and are elevated above the promenade floor and have plate glass fronts with iron bars behind them. In the arena there are two circus rings, 40 ft. in diameter, covered with very heavy mattresses on a platform of 3-in. tongue and groove planks supported by steel beams and trusses. The entire framework is carried by two hydraulic plungers that raise or lower it 14 ft. In its upper position the platform covers an 84x45-ft. approximately elliptical tank, and its edges join closely with the main floor. When aquatic performances are given, the mattresses are removed and the platform very quickly lowered to the bottom of the tank. The tank is built of concrete on the rock bottom, and its walls are reinforced with vertical I-beams and channels. An outer wall, parallel to the tank wall, encloses a space about 3 ft. wide, in which a movable steel cage 14 ft. high is ordinarily kept below floor level, enclosing the tank. When wild animal performances are given this cage is raised to enclose the arena and allow a considerable amount of freedom to the animals and their trainers without danger to the public or the obstruction and inconvenience of small cages. The proscenium arch is close to the arena and has one of the largest openings in the city, being 92 ft. wide and 37 ft. high. The 47x200-ft. stage floor has a 47x97-ft. platform of steel beams and girders supported on four hydraulic plungers by which it can be raised or lowered 8 ft., besides which there is in the center a large trap independently movable vertically, and a 30x12-ft. fixed floor on each side.



Auditorium and Rings, New York Hippodrome.

The first floor of the building is supported on the interior and exterior walls and on steel and cast-iron columns; above it there are six main columns to support the roof trusses and a few smaller ones to support the floors of the balcony, foyer and cafés. The double pitched roof over the center of the auditorium is carried by five transverse trusses marked B, in the plan diagram, which are supported by four main columns at the corners of a 108-ft. rectangle. The two end girders are connected directly to the columns, the intermediate ones are carried by a pair of very heavy longitudinal riveted trusses marked A. A. A similar but lighter transverse truss, G, over the proscenium arch is supported on two independent columns and with the other main trusses carries the inner ends of the girders for the side roofs. The hipped street corners of the roof are carried by trusses, E, E, about 64½ ft. long and 12½ ft. deep, which correspond to trusses C. The stresses and material of the main and side trusses are shown in the diagram of a half transverse section of the roof, and their details correspond to those of the typical panel points shown in elevation. Trusses C were riveted up complete at the shops, trusses B had 27-ft. lengths at each end shop-riveted complete and the members for the remaining panels shipped separately and riveted in the field, each chord having three field-riveted splices. The intermediate trusses are riveted to vertical members of the longitudinal trusses through the open holes shown in the end connection angles; the end trusses have projecting web plates field-riveted to the main columns through the open holes shown in the detail marked end truss.

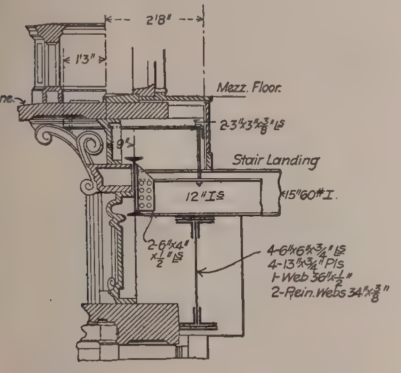
The main longitudinal trusses, A, A, are 108 ft. 3 13/16 in. long, 15 ft. 4 in. deep over all and weigh 90,000 lb. each. Their loading, stresses and materials are given on the diagram, and their details correspond with those of the proscenium rch transverse truss G, 95½ ft. long and 15 ft. in. deep, which weighs 85,000 lb. The latter russ has maximum stresses of 1,113,000 lb. and ,050,000 lb. in the top and bottom chords, repectively, and all its members were shipped separately from the bridge shop and field-riveted together at the street level, the truss being assembled in a horizontal plane and lifted bodily to position by the erection traveler, which handled the two longitudinal and six transverse main trusses n the same manner. Transverse truss D is made heavier than trusses B on account of the additional loads imposed on it by the side trusses, C, C, etc., and is 108 ft. 4 in. long, 12 ft. deep on centers, has maximum top and bottom chord stresses of 720,000 lb. and 693,000 lb., respectively, and is loaded with from 9,000 lb. to 36,000 lb. at each panel and sub-panel point of its top chord. The ends are web-connected to the vertical columns, and the chords are each made in three pieces, with two field-riveted splices.

The Sixth Avenue front is carried on wall columns, some of which are connected by plate girders over the entrance which support the outer ends of the mezzanine floor beams. These cantilever about 2 ft. beyond the girder and are web-connected to a 20-in. wall beam, which carries the stone work in the balcony and the terra cotta ornamental work, as indicated in the sectional detail.

The proscenium arch opening is so wide that it was thought necessary to provide lateral stiffening for the wall, which is suspended from the roof truss, G. A lattice girder, 95 ft. 5 in. long and 5 ft. 3 in. deep with its web in a horizontal plane, is suspended from the roof truss by vertical members 13 ft. 6½ in. apart, built into the brick wall. The girder is enclosed in a heavy plaster cornice built on a light steel furring and metallic lath, and is knee-braced at suspension points to the feet of the suspenders and to the wall girder.

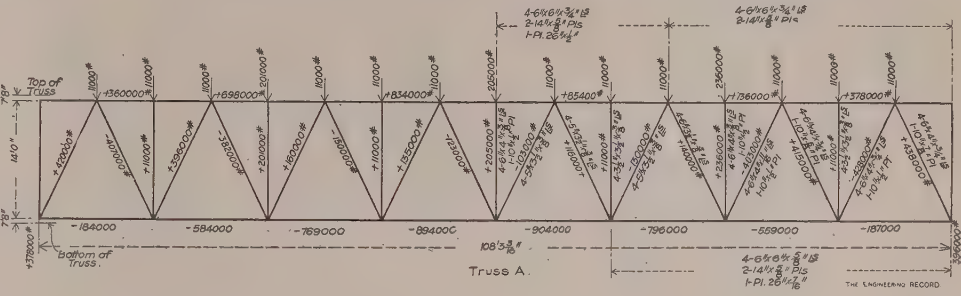
The gallery is supported on two transverse segmental rows of columns, one row at the upper end of the inclined floor and the other row about four-fifths of the way from it to the front rail. These columns in each row are connected by plate girders and I-beams, as shown in the longitudinal section. The girders provide fulcrum supports for inclined cantilever I-beams about 15 ft. apart, which are anchored at their upper ends to the beams and girders in the horizontal floor of the foyer. Midway between the fulcrum and the anchorage the cantilevers are web-connected to a line of 15-in. transverse beams, which carry smaller intermediate beams and channels from about 4½ to 5 ft. apart, parallel with the cantilevers. The rectangular ceiling between the four main columns in the auditorium is a light domed plaster shell with a steel framework, suspended from the roof trusses. It has a spherical surface of about 175 ft. radius and is panelled by deep transverse ribs radiating from the center. It is surmounted by a ventilating dome 24 ft. in diameter, and the space above it and below the roof is vacant and serves as an exhaust chamber for ventilation purposes.

Messrs. Thompson & Dundy are the owners and architects, Messrs. Purdy & Henderson are the consulting engineers and designed the structural steel work, which was fabricated by Milliken Bros., and weighs about 1,400 tons. The George A. Fuller Co. was the general contractor and erected the steel work, Mr. J. H. Morgan being manager of the architectural department, and Mr. C. E. Hammond engineer in charge of construction. The hydraulic apparatus for elevating the stage and arena platforms was designed and installed by the Otis Elevator Co., and the automatic sprinklers were installed by Francis Brothers & Gellett.

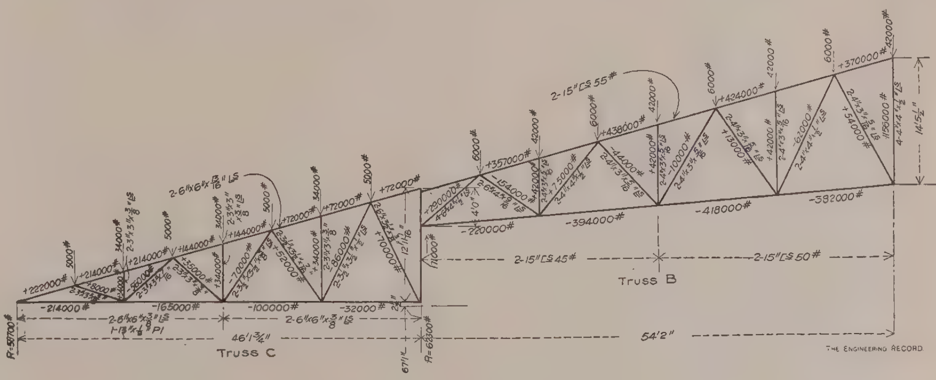


Section of Front Wall at Mezzanine Floor.

THE ENGINEERING RECORD.

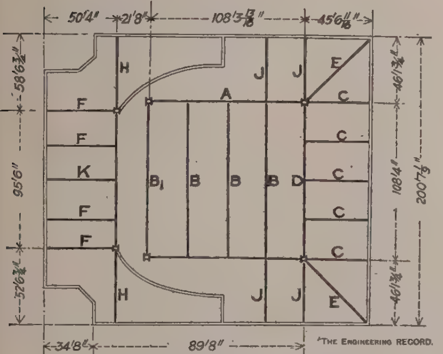


Truss A.

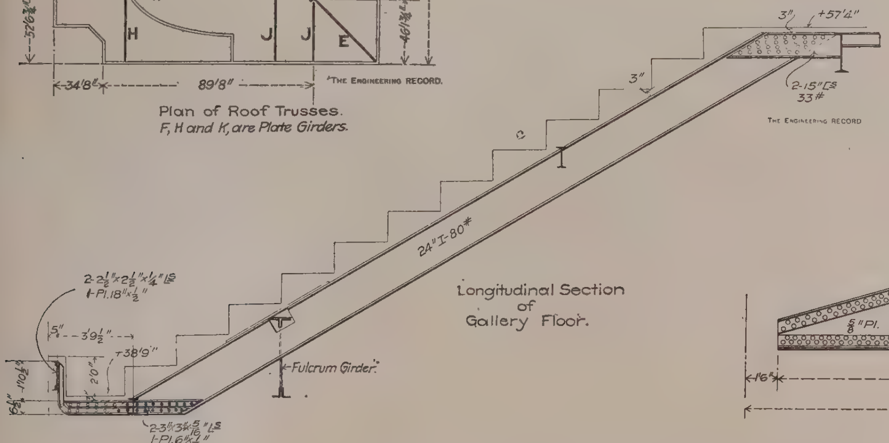


Truss C

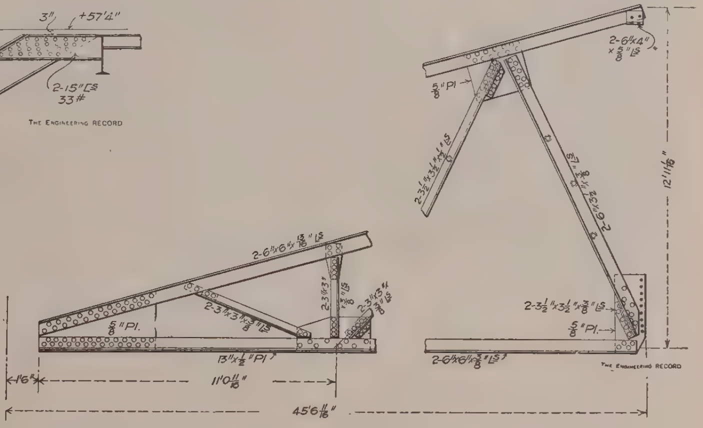
Truss B



Plan of Roof Trusses.
F, H and K, are Plate Girders.



Longitudinal Section of Gallery Floor.



Truss C

Strain Sheets, Diagrams and Structural Details of the New York Hippodrome.

THE COST OF ELECTRIC RAILWAYS in English cities was stated at a recent meeting of the Tramways & Light Railways Association to range from about $19,500 to $29,000 per mile of single track. The proportionate costs of the various kinds of work were figured as follows: For rails and fastenings, 22 per cent.; special work, 10 per cent.; paving material, 30 per cent.; cement, sand and broken stone, 14 per cent.; labor, 15 per cent.; bonds, cartage and miscellaneous items, 9 per cent.

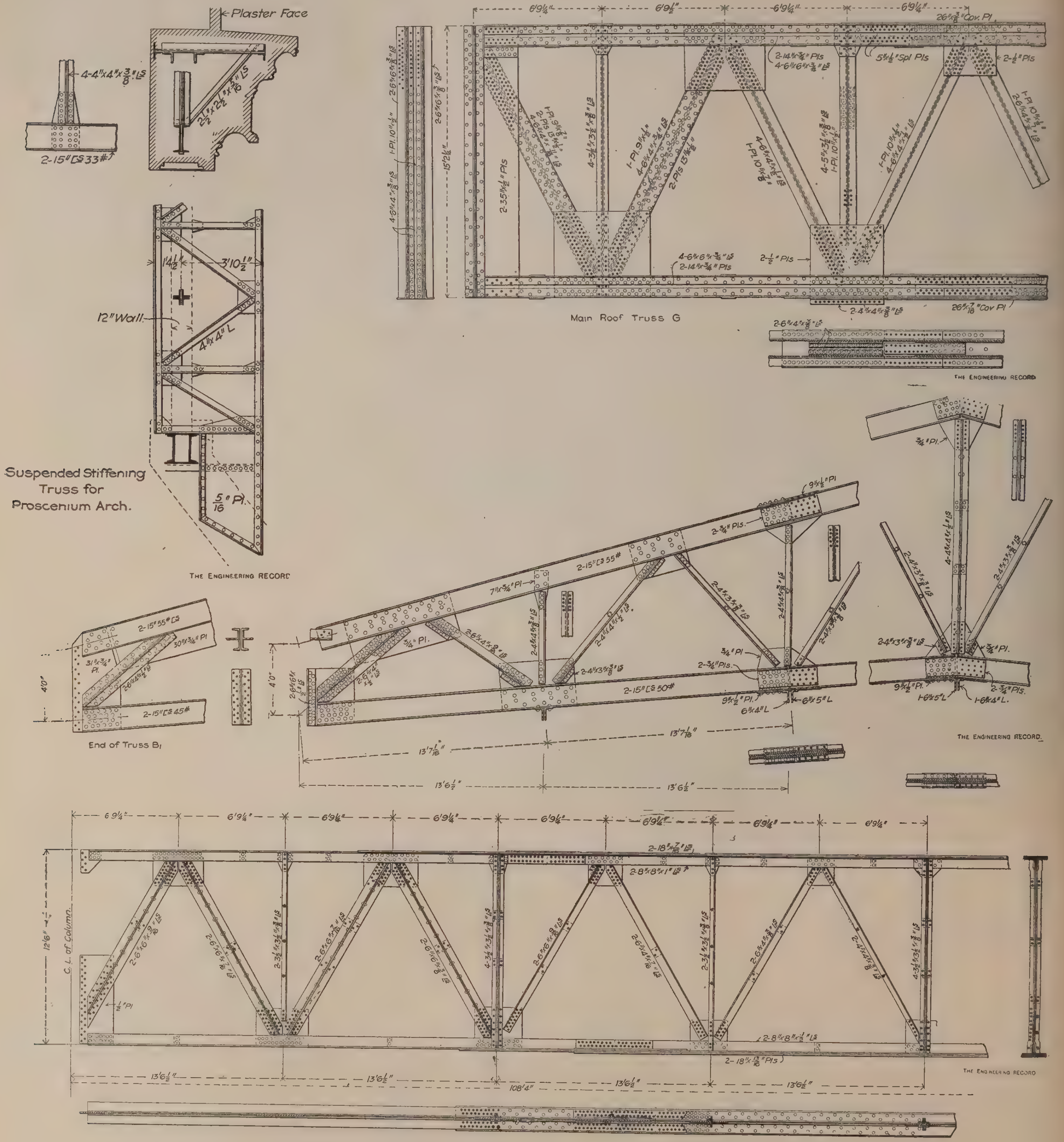
The Opportunity of the Local Cement Manufacturer.

By Frederick H. Lewis, M. Am. Soc. C. E.

There is one feature of trade conditions in Portland cement last year which so far has escaped attention; that is, the large part which transportation played in the cost to the consumer. It is conservatively estimated that the railroad freight charges on Portland cement last year were 60 per cent. of the cost of the cement in bulk at works. In quite a considerable territory the transportation charges exceeded the cost of the cement at the factory.

Speaking generally, the trade conditions in Portland cement last year afford little argument for building new factories, but viewed in their relation to transportation charges these conditions supply the strong argument and the sufficient reason for building additional local factories.

There are at this time perhaps a dozen localities where cement-making materials are to be had, and where cement can be cheaply made, to which this argument is applicable. When cement was high in price the excellent natural advantages of the Lehigh Valley district enabled it to find a widespread market regardless of freight tariffs, but when the price of cement fell to 75 cents at works, as it did last year in Pennsylvania, conditions were entirely changed. The evidence is not lacking that the industry is now in a state of transition in this regard. It has been a centralized industry, distributing much of its product to distant markets. It will become a widespread industry with local factories supplying local markets. In the year 1900, 73 per cent. of the entire output of Portland cement in this country was produced in a circle not over 30 miles in diameter, known as the Lehigh Valley district of Eastern Pennsylvania and Western New Jersey. This product was sold in all sections of the country east of the Rocky Mountains, and some of it



Main Roof Trusses and Proscenium Arch Truss, New York Hippodrome.

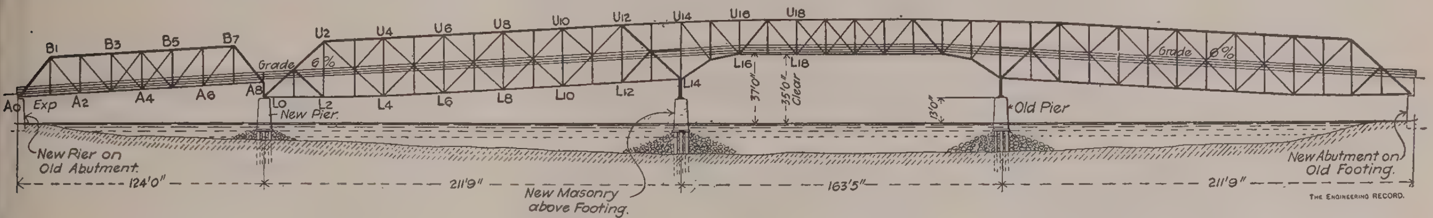
nt to the Pacific Coast. Since 1900, however, e proportion produced in the Lehigh Valley has en decreasing. In 1901 it was 68 per cent. of e whole; in 1902, 63 per cent.; in 1903, 55 per nt. This secondary development of the industry thus seen to be gaining headway rapidly, and e essential reason for it is the lower cost of the oduction of cement.

In any locality which has favorable natural con- tions and which can market the product of one ill at 25 cents per barrel advantage in freight arges over its nearest large competitor a local ctory is justified. Factories of this kind should e simple in construction, following the best ap- roved practice without venturing upon any novel r experimental features, and of a moderate out- ut. It is quite certain that the last few years re witnessing this development of the Portland ement industry as fast as capital can be made to ee the force of this argument. Speaking generally, the only conditions necessary are cheap raw materials and satisfactory fuel at moderate cost.

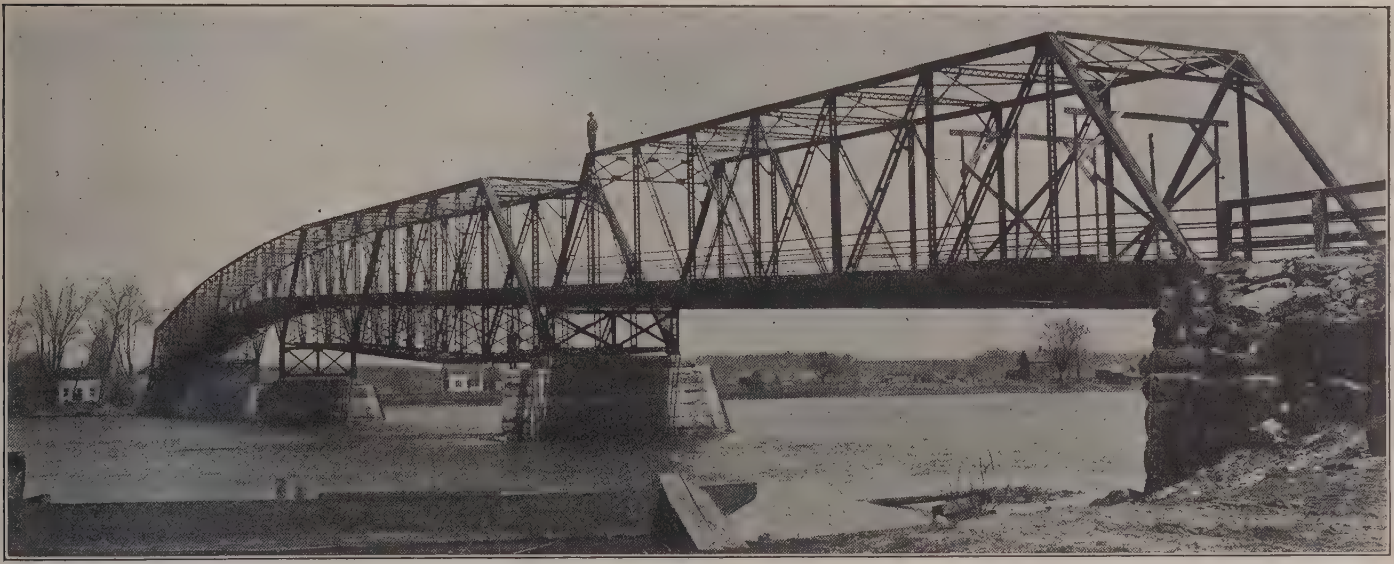
Liquid Resistance for Motor Control is employed in the hoisting plant of a German coal mine, known as Preussen II. According to London "Electrician," a three-phase motor of 650 h.p. is installed, and the useful load is 4,816 lb. of coal at a speed of 52.5 ft. per second. Each of the three phases of the rotor is led to resistance plates which are suspended in a tank set above a reservoir. Through both tank and reservoir there is kept up a constant circulation of soda solution, and as soon as the regulating valves at the bottom of the tank are closed the liquid begins to rise and allows a passage of current between the resistance plates, thus speeding up the motor. The higher the liquid rises and the greater the surface of the plates covered, the smaller becomes the resistance in the rotor circuit and the speed of the motor advances toward its full value, which occurs when the liquid has reached the overflow. The valves are controlled from a distant point.

The Erection of the Moline Bridge.

The United States highway bridge across the Rock River, near Moline, Ill., is a riveted steel truss, through structure 710 ft. long and 35 ft. in the clear above the water in the middle of the river. It has four spans of 211 ft. 9 in., 133 ft. 3 in. and 124 ft. with trusses 19½ ft. apart on centers and from 18 to 30 ft. deep. The 211 ft. 9 in. side spans have two-panel cantilever arms from which the 103-ft. connecting trusses are suspended by short vertical tension links. The design is peculiar in that the ends of the main spans are supported on steel rocker bents on the masonry piers and that in only the center span are the parallel chords horizontal, being included in the side spans nearly as much as the steeply graded floor stringers. This gives the bridge an unusual appearance, and carries the floor about midway between the top and bottom chords of the side trusses as shown in the general view accompanying the description of the superstructure which was published in The Engineering Record of Feb. 11.



General Elevation of Cantilever and Anchor Spans.



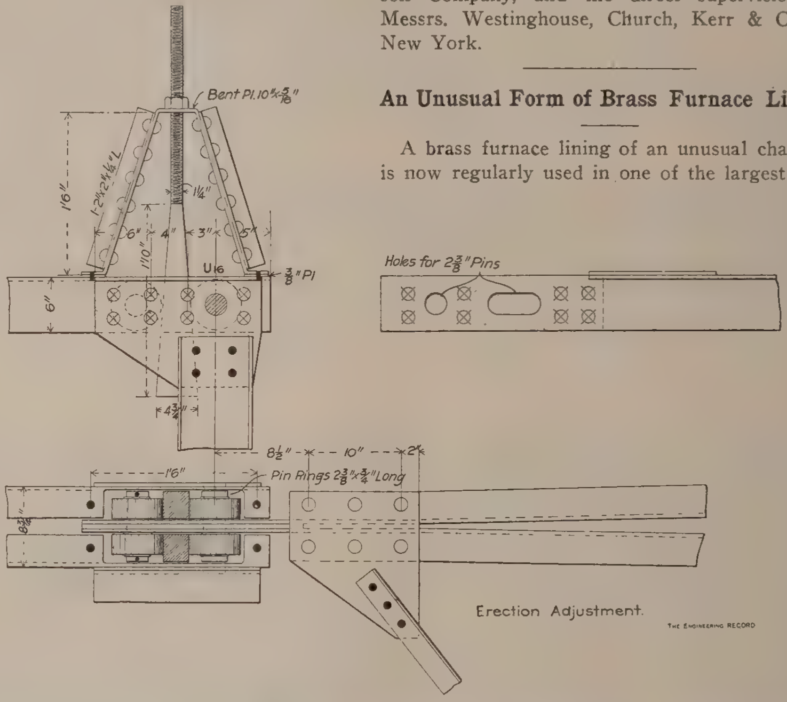
Elevation and General View of New Moline Bridge.

All metal was shipped to Davenport, Iowa, transferred to barges and towed to the bridge site, a distance of about twelve miles. The end span and the two main side spans were erected on ordinary falsework made with three vertical piles in each bent. The outside piles were 23 ft. apart transversely, and longitudinal timbers for the traveler track were laid on their centers. Just inside these timbers the 12x12-in. caps supported pony bents of varying heights. Each of them had two vertical posts set close to the traveler-track stringers capped and braced by diagonals from the center of their caps to the ends of the main caps. These vertical posts were in the planes of the trusses which they directly supported. The trusses were assembled by an ordinary two-bent four-wheel gantry traveler built with 6x6 and 8x 8-in. posts. It had horizontal and vertical clearances of about 22 ft. and 44 ft., respectively, and was provided with two longitudinal 10x12-in. jigger beams for the hoisting tackles which were operated by four hand crabs bolted to the intermediate vertical posts provided for that purpose in the lower panels of the longitudinal faces of the traveler. Each longitudinal side was X-braced in two vertical panels. After erecting the trusses on one side of the river, the traveler was rolled onto a tower built alongside the falsework. The vertical posts of this tower were seated on heavy bob-sleds by means of which the tower and traveler were easily drawn across the river on the ice and the traveler was then moved off from the tower to the falsework and proceeded to erect the trusses on that bank. During the transit across the river the traveler was steadied by guy lines from the top which were tended by men walking alongside. Great care was, however, taken with the movement, and these guys were not brought into action. They were provided principally to insure stability in case of heavy winds, which did not occur.

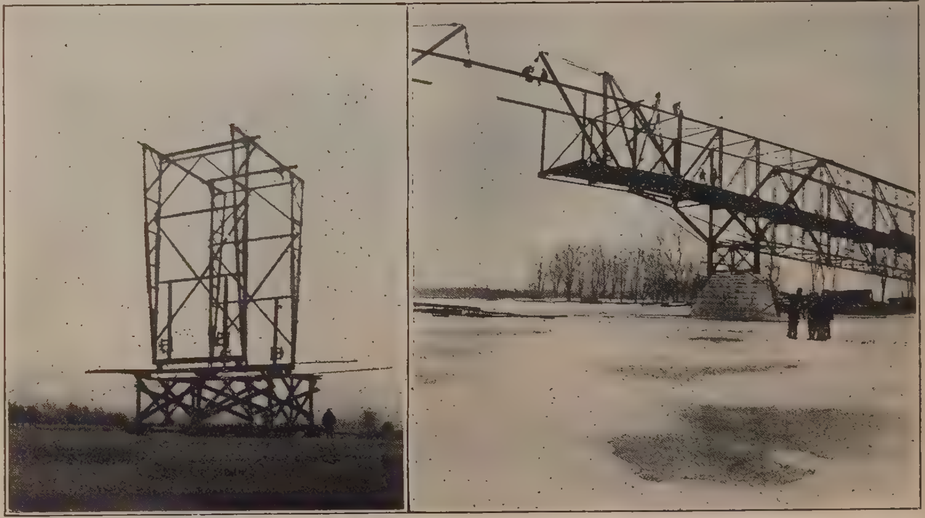
Between the river piers the cantilever arms and the center truss were erected by the cantilever method with movable stiff-leg boom derricks running on the finished bridge floor. The erection adjustment between the two sections of the nominal member of the top chord at U-116 was made with a light simple wedge and roller device of the ordinary type. At this point the nominal intersects the vertical, but there are no diagonal members. Each section of the nominal member is composed of a pair of angles with their vertical flanges turned downwards. In U-15, U-16 the horizontal flanges are turned inwards, and the vertical flanges are 8¾ in. apart over all, thus making a trough-like section closed on top. In U-16 U-17 the angles are riveted together back to back to make a T-shape cross-section and the horizontal flanges are cut to clear the end of U-15 U-16. The vertical webs project into the end of U-15 U-16, and engage with a slotted hole 6 in. long the 2⅜-in. pin in the top of the vertical post. A second 2⅜-in. pin nearly 8 in. long engages a round hole in the end of U-16 U-17, 11½ in. from the center of the slotted hole. This pin clears the webs of U-15 U-16, and receives on each side of its center bearing in U-16 U-17, a cast-iron roller 2¼ in. thick and 5½ in. in diameter. A pair of similar rollers were placed on pin U-16 and the two sets of rollers were separated by a pair of vertical planed wedges, as shown in the detail of the connection at U-16.

The upper ends of the wedges terminated in a screw rod commanded by a nut bearing on a riveted frame bolted to U-15 U-16. The wedges were set so as to separate the pairs of rollers and elevate the top chord of the center span during erection above its normal position. When the final connections were made at the center of the span, the wedges were slacked off by means of the nut and allowed the ends of the top chords to descend to the required position where they were connected. After the erection was completed, the wedges were removed and the riveted frames were unbolted and taken off, but the rollers remained enclosed in the nominal member U-15 U-16.

The bridge was built for the United States Government, and was constructed under the supervision of Mr. W. L. Marshall, Major Engineers, U. S. A. It was fabricated at the Milwaukee Bridge & Iron Works of the J. G. Wagner Co. The erection was in charge of Mr. Martin Barmel, now chief erector of the Milwaukee Bridge Co.



Erection Adjustment.



Moline Bridge: Moving Traveler across Ice; Connecting Center Panels of Top Chord.

Some Departures in Design in a Detroit Central Power Station.

Departures in power plant design that may be said to represent in a large measure the effect of the introduction of the steam turbine are typified in the new station of the Detroit Edison Company, a majestic structure on the outskirts of Detroit on the Detroit River. It is of the class in which the boilers are arranged endwise with respect to the turbine room, each turbine practically opposite the row of boilers provided to supply the steam for the unit and its auxiliaries, but the point of chief prominence is the composite character of the building itself, which, though treated to stand as a single building, is, on analysis, found to consist of several parts of different heights.

Of these various parts, the most interesting is the condenser house, which constitutes an annex to the side of the turbine room, with its roof about on the level with the tops of the turbo-generator units. The condensers are placed in it on the level of the basement of the turbine room and yet close to the turbines, so that the length of the exhaust connections is not relatively long. This brings the condensers in a well lighted space, with plenty of room to work around them and a crane, traveling the length of the room, has also been provided. The condenser pumps, however, are housed in a separate building, which is likewise supplied with a traveling crane. While it has been noted that in some recent plants the pumping equipment, especially that required for the turbine surface condenser, has been freed from its formerly crowded and subordinate position, and has been housed in an addition to the operating room, a detached building was set apart in the present case, between the station and the river, for all the general pumping machinery, placed practically over the intakes.

It will not be possible in this connection to explain the many features of the station building, which also include, for example, a coal hoisting and crushing tower with the Hunt system of coal handling, built against one corner of the boiler houses and constructed to harmonize with the plant as a whole, and the added length given to the turbine room, so that it could take in at one end a through railroad siding under the control of the traveling crane. A brief statement of the equipment is as follows: Each of the four 3,000-kw. Curtis four-stage turbines provided for is supplied with steam at 200 lb. pressure superheated 200° Fahr., from a row of six 520-h.p. Stirling water-tube boilers. These are equipped with Roney stokers, and for each group of six there is a Green economizer and a 15-ft. induced draft fan driven by a Chandler & Taylor engine. Three stacks are comprehended for the four rows of boilers, the central or larger one, 16 ft. in inside diameter and 132 ft. high, taking the gases from two banks of boilers. The smaller stacks are of the same height but 11 ft. in diameter. All of them are of steel lined throughout with common red brick.

The four rows of boilers are made to face in pairs two common firing spaces, and each of the two boiler rooms thus formed has an overhead coal bunker, with three longitudinal divisions in it, one over the central gangway. The coal chutes to the stoker hoppers can take from the central division or from the adjacent side division, and different grades of coal can be kept so that, for example, low grades can readily be burned during light loads.

Each condenser is of the Wheeler type, with 12,000 sq. ft. of surface, and the corresponding air pump is a three-cylinder Edwards electrically driven from a 50-h.p. induction motor. The centrifugal pumps are of the Worthington type, driven by 75-h.p. motors. There is a Cochrane feed-water heater for each group of six boilers and a Worthington compound outside-packed plunger pump in each case, 12 and 18x18½x18 in., in size, located in the boiler room. The cranes, which were built by the Northern Engineering Co., are of the hand operated type in the pump house and condenser room. The station was built under the general supervision of Mr. Alex. Dow, general manager of the Detroit Edison Company, and the direct supervision of Messrs. Westinghouse, Church, Kerr & Co., of New York.

An Unusual Form of Brass Furnace Lining.

A brass furnace lining of an unusual character is now regularly used in one of the largest brass casting foundries in the country. A wooden cylinder is placed inside the furnace, leaving the same space between the cylinder and furnace wall that is usually occupied by firebrick. Dixon's graphite crucible mixture is then made into a mortar with water to which silicate of soda has been added, at the rate of half a pound of silicate to a gallon of water. The mixture is poured into the space, where the silicate causes it to set quickly, permitting the withdrawal of the cylinder. In making repairs, the worn parts are broken away and the cracks and holes filled with the mortar, the use of the wooden cylinder frequently being unnecessary in such work.

integration of Portland Cement Briquettes by Oil and Experiments to Prevent It.

James C. Hain, Engineer of Masonry Construction, Chicago, Milwaukee & St. Paul Ry.

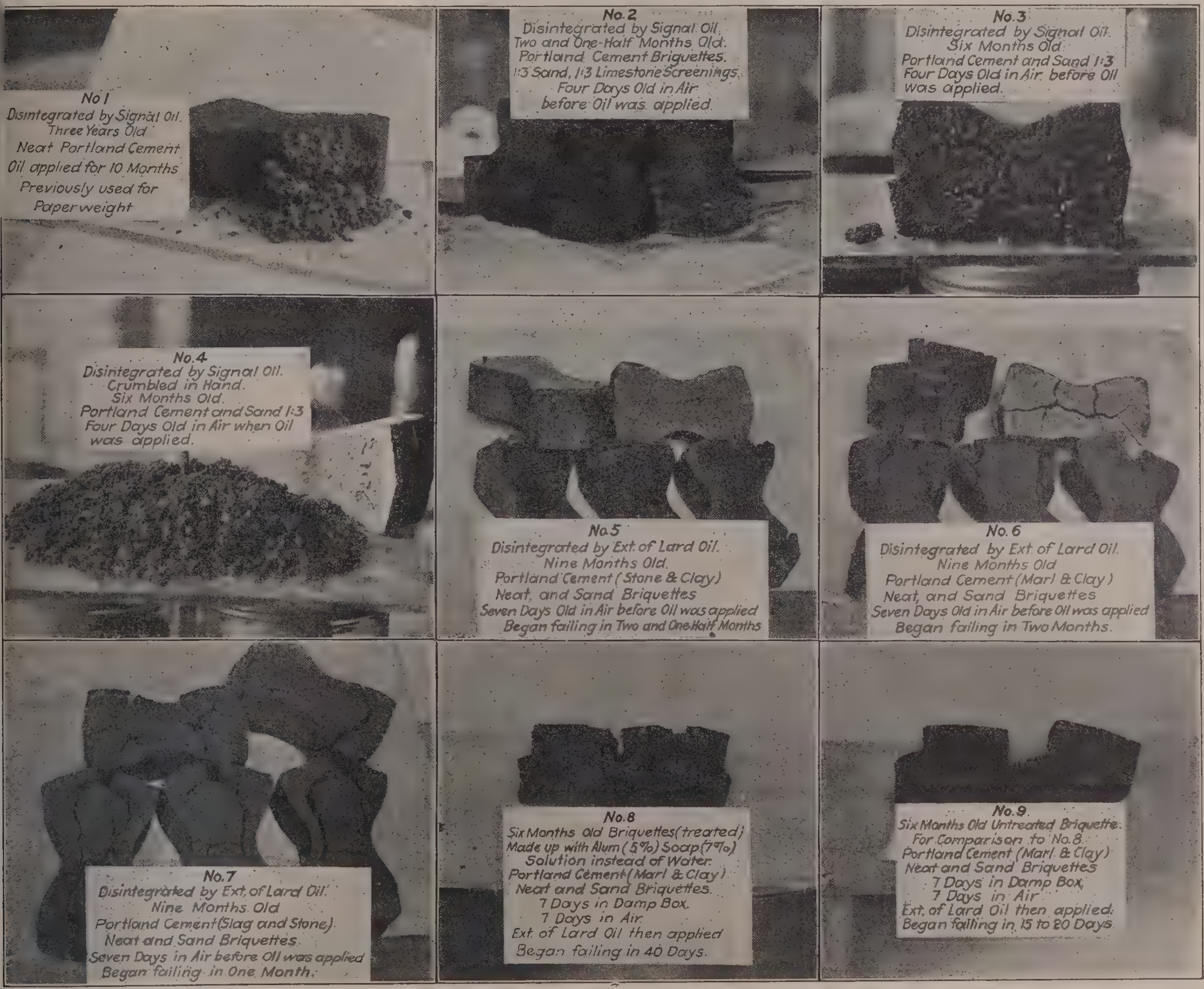
About two years ago, Jan., 1903, it was acci-
ntally discovered in the cement testing labora-
y of the C., M. & St. P. Ry., Mr. C. F. Loweth,
gineer and superintendent of bridges and
ildings, that oil disintegrates Portland cement.
iefly the circumstances were as follows: A two-
ar-old neat Portland cement briquette which
d been in use in the laboratory as a paper
ight was laid aside where it was exposed
occasional drippings of signal oil. In ten
nths the briquette began to disintegrate. Pho-
ograph No. 1 shows the effect after being exposed as above for that period.

Up to that time, two years ago, there was considerable difference of opinion in regard to the effect of oil on concrete. In fact, there is to-day. Many consider it entirely harmless, and to prove their assertions call attention to machinery foundations in use for many years, which, though exposed to waste oil, are perfectly sound. On the other hand, there are many who believe the contrary to be true, and tell about concrete disintegrating where oil appeared to be the sole cause. The laboratory test above referred to proves clearly that oil must have a powerful effect on concrete mortar, to disintegrate a two-year-old briquette. It therefore seemed of great value to make further investigations, because concrete is used extensively in places where waste oil cannot be avoided, such as engine and machine foundations, turn-table and round-house pits, drawbridge piers and abutments, floors in oil storage houses, etc. The result of the discovery referred to indicates that concrete when used where oil can reach it may disintegrate in time and thus result seriously.

Consequently, we started an investigation. An examination was made of a great many concrete structures on which more or less oil was found. There were a limited number of instances where it possibly was affected by oil. In these cases, however, the concrete was very old, and the character of the original material and the workmanship were questionable. On the other hand, none which was built in late years and known to be of good quality was effected to any perceptible degree, if at all. One case which particularly attracted our attention, was the concrete floor of an oil house in which lubricating and lighting oils had been stored for six years without any apparent effect. The penetration of the oil was slight, perhaps not to exceed $^1/_{16}$ in. Moreover, the saturated portion seemed to be as sound as the rest. There were other cases where the oil had penetrated deeper. For example, in the pits of a round-house the oil had gone in from ¼ to ½ in. In other respects, the concrete seemed perfectly natural. These pits, however, had been in use only about a year when investigated. It will thus be seen that our observations of concrete structures proved nothing definite. While the investigation seemed favorable for the structure examined, it could not be taken as conclusive for all concrete structures.

We then decided upon laboratory experiments. These tests consisted of Portland cement briquettes, made of neat cement, 1:3 of sand and 1:3 of limestone screenings, which were allowed to age four days in the laboratory air, and were then subjected to applications of signal oil. (See "First Series" in Table 1.) At first, small quantities of oil (enough to saturate) were applied daily. Later, the applications were less frequent, depending upon the amount the briquette absorbed. Cracks developed in the sand and limestone briquettes first. They appeared in these at the age of 2½ months. The effect is seen in photograph 2. The neat briquettes showed similar results in five months. A sand briquette of the same series is shown in photograph 3, at the age of six months, when larger cracks had developed. Photograph 4 is the same briquette after crushing in the hand, thus showing the disintegration to be complete. All briquettes eventually disintegrated.

After being convinced of the results of the above, a still more extensive series was started. Previous tests were confined to one oil (signal)


No 1
Disintegrated by Signal Oil.
Three Years Old
Neat Portland Cement
Oil applied for 10 Months
Previously used for
Paperweight
No. 2
Disintegrated by Signal Oil.
Two and One-Half Months Old.
Portland Cement Briquettes.
1:3 Sand, 1:3 Limestone Screenings.
Four Days Old in Air
before Oil was applied.
No. 3
Disintegrated by Signal Oil.
Six Months Old
Portland Cement and Sand 1:3
Four Days Old in Air before Oil
was applied.
No. 4
Disintegrated by Signal Oil.
Crumbled in Hand.
Six Months Old.
Portland Cement and Sand 1:3
Four Days Old in Air when Oil
was applied.
No. 5
Disintegrated by Ext. of Lard Oil.
Nine Months Old.
Portland Cement (Stone & Clay)
Neat, and Sand Briquettes
Seven Days Old in Air before Oil was applied
Began failing in Two and One-Half Months
No. 6
Disintegrated by Ext. of Lard Oil.
Nine Months Old
Portland Cement (Marl & Clay)
Neat, and Sand Briquettes
Seven Days Old in Air before Oil was applied
Began failing in Two Months.
No. 7
Disintegrated by Ext. of Lard Oil.
Nine Months Old
Portland Cement (Slag and Stone).
Neat and Sand Briquettes.
Seven Days in Air before Oil was applied
Began failing in One Month.
No. 8
Six Months old Briquettes (treated)
Made up with Alum (5%) Soap (7%)
Solution instead of Water.
Portland Cement (Marl & Clay)
Neat and Sand Briquettes.
7 Days in Damp Box.
7 Days in Air.
Ext. of Lard Oil then applied
Began failing in 40 Days.
No. 9.
Six Months Old Untreated Briquette.
For Comparison to No. 8.
Portland Cement (Marl & Clay)
Neat and Sand Briquettes
7 Days in Damp Box.
7 Days in Air.
Ext. of Lard Oil then applied.
Began failing in 15 to 20 Days.

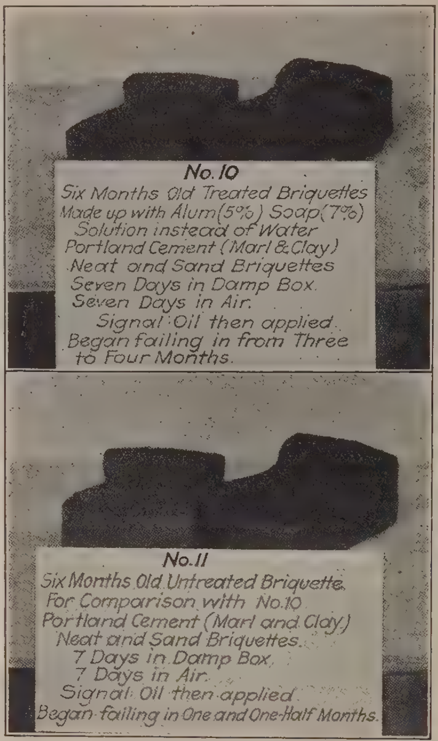
Illustrations of Briquettes of Various Compositions Which Were Exposed to the Action of Oil.

and a single cement. This "Second Series," (see Table 1) included a characteristic oil or fat from each of five different groups which are most common, and one each of the three varieties of cement in which they may be classed according to the raw material from which they are manufactured. The oils and fats used were extract of lard among animal fats, whale oil among animal oils, castor oil and boiled linseed oil as representing respectively semi-drying and drying vegetable oils, and crude petroleum among mineral oils. In addition to these, signal oil (which is a mixture of animal fat and mineral oil), was also used because it served for a comparison to the previous tests. In choosing the cement, a well-known brand of Portland cement was selected from those manufactured from stone and clay, another from marl and clay, and the third from slag and stone.

Neat and 1:3 sand briquettes from all these varieties of cement were then made, and treated each with the six different kinds of oils and fats. A total of about 800 briquettes was required to cover the entire series of tests (including those made for comparison but not treated with oil). All briquettes were left in the laboratory air seven days before starting the oil treatment, which was similar to that used in the former test. The oil applications were continued until the tests ended, or nine months after they were started. Tensile tests were obtained of the oil treated briquettes and also (for comparison) of two similar sets without oil, one of which was kept in water and the other in laboratory air. The briquettes were broken at 28 days, 3, 6, and 9 months, except when disintegration prevented.

In regard to the results, I will not take the space to reproduce the tensile tests. All other information regarding them is shown in the Second Series of Table 1. It will suffice to discuss the most important features. The greatest effect was caused by animal fat or extract of lard oil. It disintegrated most of the neat and sand briquettes in from ½ to 2½ months. However, it failed to destroy some, even at the end of nine months, when the tests were discontinued. As a rule the neat briquettes were affected first, which was contrary to what was noticed in the first series of tests. Photographs 5, 6 and 7 show the results of the lard oil treatment on the nine months old briquettes of all three varieties of cement. It will be seen that the stone-clay class was disintegrated the least and the slag-stone the most. The above order of disintegration, however, was not followed in all cases. In this connection I also wish to say that the materials out of which a cement is made do not seem to govern the effect of the oil; instead, the peculiar characteristics of each cement apparently regulate that.

Next in effect was signal oil, a mixture of animal fat and mineral oil. It acted only slightly different from the extract of lard. Following this were the whale and castor oil. They caused considerably less disintegration than either of the two before mentioned. Only a small percentage of the briquettes treated with these oils was affected in outward appearance up to the end of the test. The two remaining oils, petroleum and boiled linseed, did not disintegrate any of the briquettes up to nine months. Petroleum, however, penetrated and affected the strength somewhat, and possibly would have eventually destroyed it, while boiled linseed formed a coating without penetrating. Of the five classes, boiled linseed was the only one that apparently did not affect the strength of the briquettes. This, no doubt, was due to oxidation which prevented it from soaking in. Had it not dried before penetrating, it possibly would have disintegrated the briquette to the same effect as castor, the other vegetable oil used.


No. 10
Six Months Old Treated Briquettes
Made up with Alum (5%) Soap (7%)
Solution instead of Water
Portland Cement (Marl & Clay)
Neat and Sand Briquettes
Seven Days in Damp Box.
Seven Days in Air.
Signal Oil then applied.
Began failing in from Three to Four Months.
No. 11
Six Months Old Untreated Briquette.
For Comparison with No. 10
Portland Cement (Marl and Clay)
Neat and Sand Briquettes.
7 Days in Damp Box.
7 Days in Air.
Signal Oil then applied.
Began failing in One and One-Half Months.

Briquettes Affected by Oil.

TABLE 1.—EFFECT OF OIL ON PORTLAND CEMENT BRIQUETTES.

Date made.	Class of Portland cement.	Briquettes.	Method of curing briquettes. In water.	In laboratory air.	Dried in warm air.	Oil applications. Age when started.	Time applied to date (where not disintegrated).	Extract lard oil. No. briq. made.	Time applied before disintegrated.	Whale oil. No. briq. made.	Time applied before disintegrated.	Castor oil. No. briq. made.	Time applied before disintegrated.	Linseed oil (boiled). No. briq. made.	Time applied before disintegrated.	Petroleum (crude). No. briq. made.	Time applied before disintegrated.	Signal oil No. briq. made.	Time applied before disintegrated.
Original Discovery.																			
Jan., 1900	Stone and clay	Neat		2 yrs.	....	2 yrs.	....	..	....	..	....	..	....	..	.	..	.	1	10 mo.
Aged Briquettes—Regular Treatment.																			
Feb., 1901	Silica cement made	Neat	2 yrs.	....	20 da.	2 yrs.	2 yrs.	..	....	..	....	..	....	..	.	..	.	1	sound
	by grinding together	1 to 1	2 yrs.	....	20 da.	2 yrs.	2 yrs.	..	....	..	....	..	....	..	.	..	.	1	sound
	equal parts of cement	1 to 2	2 yrs.	....	20 da.	2 yrs.	2 yrs.	..	....	..	....	..	....	..	.	..	.	1	sound
	(sand and clay class) and sand.	1 to 3	2 yrs.	....	20 da.	2 yrs.	....	..	....	..	....	..	....	..	.	..	.	1	2 yrs.
Odd Tests.																			
Sep., 1902	Stone and clay.	Neat	28 da.	3 mo.	....	4 mo.	....	..	....	..	....	..	....	..	.	..	.	1	8 mo.
Feb., 1903	Marl and clay.	Neat	....	1 mo.	....	1 mo.	....	..	....	..	....	..	....	..	.	..	.	1	6 mo.
First Series.																			
Mar., 1903	Stone and clay.	Neat	....	4 da.	....	4 da.	....	..	....	..	....	..	....	..	.	..	.	18	5 mo.
Mar., 1903	Stone and clay.	1:3 sand	....	4 da.	....	4 da.	....	..	....	..	....	..	....	..	.	..	.	18	2½ mo.
Mar., 1903	Stone and clay.	1:3 limestone screenings	....	4 da.	....	4 da.	....	..	....	..	....	..	....	..	.	..	.	18	2½ mo.
Second Series.																			
Jan., 1904	Stone and clay.	Neat	....	7 da.	....	7 da.	....	18	3 mo.	18	*	18	..*	18	*	18	*	18	*
Jan., 1904	Stone and clay.	1:3 sand	....	7 da.	....	7 da.	9 mo.	12	*	12	*	12	..*	12	*	12	*	12	*
Jan., 1904	Marl and clay.	Neat	....	7 da.	....	7 da.	....	18	2⅔ mo	18	*	18	..*	18	*	18	*	18	6 mo.
Jan., 1904	Marl and clay.	1:3 sand	....	7 da.	....	7 da.	9 mo.	12	*	12	*	12	..*	12	*	12	*	12	*
Jan., 1904	Slag and stone.	Neat	....	7 da.	....	7 da.	....	18	1 mo.	18	3 mo.	12	4 mo.	18	*	18	*	18	1¼ mo.
Jan., 1904	Slag and stone.	1:3 sand	....	7 da.	....	7 da.	....	12	7 mo.	12	4¼ mo.	12	6½ mo.	12	*	12	*	12	4 mo
Grand total briquettes, 600.						Total briquettes		90		90		90		90		90		150	

*Sound after applying oil 9 mo., at which time tests were discontinued.

We have now seen the effect of oil on the weaker briquettes. I say weaker, because it will be remembered that the first series of tests, which consisted of only a few, were treated with oil after four days old, and the second longer series after seven days. Also that these were not regularly cured briquettes, but exposed to the laboratory air instead of water after making. This method was used to allow the briquettes to dry so they would more readily absorb the oil. Therefore, their age when the oil was first applied, and the method of curing naturally made these briquettes more susceptible to oil than if they were older and cured in water. This was intended in order to make the effect of the oil treatment more pronounced. To supplement the tests on these weaker briquettes, experiments were made with older ones which were cured according to the regular laboratory practice. Some of these tests follow.

A neat, a 1:1, a 1:2 and a 1:3 sand briquette, all of which were two years old, were dried at the stove for twenty days, and then treated with signal oil. It has been practically two years since the oil was first applied. With one exception they show no signs of disintegration, and this was only noticeable since the paper was started. I will add also, that the above briquettes were made of silica cement instead of regular Portland, which consisted of equal portions of sand and Portland cement, ground together to a fineness that passed through a No. 200 sieve. In other words, these briquettes are weaker than the standard Portland cement briquettes of the same mixture. The one that failed was the weakest of the four, being a mixture of one of silica cement to three of sand.

Again, a neat and a 1:3 sand briquette were taken from the vat at the age of one year and treated with signal oil. They appear to be perfectly sound though soaked in oil for practically one year. Still another specimen was a 28-day neat briquette which was dried by exposing to oratory air for three months. Signal oil was n applied. At the age of eight months the quette was disintegrated. Eight one-year-old quettes were also included in this series. They sound. However, they were immersed in oil ly nine months, and moreover were otherwise ated to prevent the action of the oil. (These will speak of later.) In connection with this ies of older briquettes, we are experimenting th a piece of concrete from the oil house floor fore mentioned, which, though in use for six ars, was not perceptibly affected. This piece concrete has now been immersed in oil for ten onths, and is still sound. It will thus be seen at only two briquettes out of the long-time ries of fifteen failed, both of which were the eakest in the lot. One of these was 28 days old hen taken from the vat, which, if an average iquette, would have broken at from three-quarrs to seven-eighths of its ultimate strength. The her, while set for two years in water, was a mparatively lean mixture, being made of one art of silica cement and three parts of sand. This briquette would have broken at from three-uarters to seven-eighths of the strength of a 1:3 regular Portland). The specimen of concrete and the rest of the briquettes show no signs of ailure. However, the oil has penetrated hroughout, and also possibly weakened them.

Thus far, our investigation may be summarized riefly as follows: At the outset we failed to find specimen of concrete that we felt was positively disintegrated by oil, though we not infrequently heard of it; for example, the pedestal nder a cream separator, which case seemed posible because it is an instance of almost continued pplication of animal fat, apparently the worst ondition that could exist. On the other hand, lenty of concrete was found that oil had penerated but not disintegrated. Further, our tests n comparatively new briquettes, which were veakened by exposure to air, showed that with ne exception they were disintegrated by all lasses of oils and fats. These oils and fats, when rranged according to their effect (as far as our xperiments indicate) are animal fat, animal oil, egetable oil and mineral oil. The exception to he above was the drying vegetable oil, which, unike semi-drying, oxidized before penetrating. It was apparently the only one which had no effect. In these tests animal fat had a much greater effect than the oils. Only a small percentage of the briquettes was disintegrated by the oils which contained no fat at the end of the tests, or nine months after the first application. (I wish to add here, however, that our tests are not extensive enough to say whether the above arrangement of the classification of fats and oils according to their effect on briquettes would hold true if other oils had been experimented with, because their chemical compositions vary so much). And last, out of fifteen old briquettes which were seasoned according to the laboratory practice, only two have been outwardly affected, though treated from nine months to two years. These two were the weakest, as before pointed out. The briquettes which remained unaffected were cured from one to two years in water. Though only two of the fifteen have been destroyed by oil, all have been penetrated, and also possibly will fail in time.

With all this in view, we are still in the dark as to the possible final effect of fats and oils on concrete structures. On the following points, however, we are reasonably certain: First, most oils penetrate concrete mortar, which makes them dangerous. Second, concrete is more liable to be disintegrated when saturated with oils and fats if not thoroughly set. Third, a good quality of concrete is less susceptible to the effect of oil than a poor, such as a porous, frosted, lean, poorly mixed or improperly seasoned concrete. Fourth, ordinary concrete work is rarely subjected to continued large doses of oils. It is more often only occasionally spattered. Disintegration under the latter conditions seems remote, especially in the case of first-class, well-seasoned concrete. (The concrete floor above mentioned is an excellent example. The oil spattered on it perhaps was oxidized or absorbed by the dust, and instead of penetrating, helped to protect it.) Last, even though subjected to the equivalent of continued saturation, the disintegration would be long drawn out if the concrete were properly made and well set.

Our conclusions may eventually be altered, though it must necessarily be a long time before definite results will be obtained from the tests under way. In the meantime, more experiments will be started, especially on concretes of poor quality, and also tensile tests on well-seasoned briquettes.

Table 1 shows the effect of oils on Portland cement briquettes which I have just finished discussing. A study of it will perhaps reveal more than has been said. It does not include the tensile tests or the untreated briquettes which were made for comparison.

We have now seen the effect of oil; next we are naturally interested to know what will prevent it. Under ordinary conditions, it seems very desirable to use a wash for oil-spattered concrete that will prevent oils from penetrating. It is also possible that concrete seasoned according to ordinary practice will not resist oil as well as the water-cured briquettes. Most of all to be protected are oil-spattered reinforced structures. Where, as in these cases, the strength depends entirely upon the quality of the concrete, we cannot afford to take chances. It would then be a great relief if some simple wash could be applied to protect it from oils.

While experimenting with the effect of oils, we made several attempts to discover something that would answer the purpose. Our attention was first attracted to linseed oil. This did not penetrate, but formed a coating on the outside of the briquette which apparently protected it. However, after two months' application of signal oil, the linseed oil was penetrated, and later the briqette was disintegrated. Other oils are slower in their action on linseed oil.

Another experiment was made with alternate washes of a 5 per cent. solution of alum and a 7 per cent. solution of castile soap, which is known as Sylvester's process of making concrete impervious to water. The combination of the two forms an insoluble precipitate which fills the voids. Five washes of each were applied alternately. The coating failed to prevent the oil from attacking the mortar.

These same solutions were also tried in a different way. The briquettes were made with the solutions instead of water. One solution was first thoroughly mixed with the cement, the other solution added and the materials then molded into a briquette. When treated with oil, these showed up inferior to the other method. Moreover the

TABLE 2.—EFFECT OF SIGNAL OIL AND EXTRACT OF LARD OIL ON PORTLAND CEMENT BRIQUETTES TREATED TO PRESERVE THEM.

		Method of curing briquettes.					Oil applications.		Signal oil.				Extract of lard oil.			
									Neat briq.		1:3 sand briq.		Neat briq		1:3 sand briq.	
Date made.	Class of Portland cement.	In laboratory air.	In damp air.	In water.	Dried in warm air.	Time treated with preservative.	Age when started.	Time applied to date (when not disintegrated).	No. briq. made	Time applied before disintegrated	No. briq. made	Time applied before disintegrated	No. briq. made	Time applied before disintegrated	No. briq. made	Time applied before disintegrated
SYLVESTER'S PROCESS I.—5% alum and 7% soap solution. Five coats began dissolving in 15 days.																
June, 1903	Stone and clay	....	....	1 yr.	14 da.	1 da.	$1\frac{1}{24}$ yr.	9 mo.	1	sound	1	sound	1	sound	1	sound
Regular briquettes to accompany above.																
June, 1903	Stone and clay	....	....	1 yr.	14 da.	1 da.	$1\frac{1}{24}$ yr.	9 mo.	1	sound	1	sound	1	sound	1	sound
LINSEED OIL.—This oil oxidized and formed a hard coating. Above oils dissolved coat.																
Jan., 1904	Stone and clay	6 mo.	....	....	....	6 mo.	6 mo.	8 mo.	1	sound	1	sound	1	sound	1	sound
Jan., 1904	Marl and clay	6 mo.	....	....	....	6 mo.	6 mo.	8 mo.	1	sound	1	sound	1	sound	1	sound
Jan., 1904	Slag and stone	6 mo.	....	....	....	6 mo.	6 mo.	8 mo.	1	2 mo.	1	sound	1	2 mo.	1	sound
SYLVESTER'S PROCESS II.—Briquettes made up with 5% alum and 7% soap solution instead of water.																
June, 1904	Marl and clay	7 da.	7 da.	....	....	....	14 da.	....	3	4 mo.	3	5 mo.	3	45 da.	3	38 da.
Regular briquettes to accompany above.																
June, 1904	Marl and clay	7 da.	7 da.	....	....	....	14 da.	....	3	1½ mo.	3	1½ mo.	3	15 da.	3	20 da.
PARAFFINE I.—Applied hot to cold briquette—coated only. Oils dissolved coating in 1½ mo.																
Sept., 1904	Stone and clay	14 da.	....	14 da.	....	1 da.	28 da.	4 mo.	1	sound	1	2 mo.	1	sound	1	2 mo.
Sept., 1904	Marl and clay	14 da.	....	14 da.	....	1 da.	28 da.	4 mo.	1	sound	1	2 mo.	1	sound	1	2 mo.
Sept., 1904	Slag and stone	14 da.	....	14 da.	....	1 da.	28 da.	4 mo.	1	sound	1	2 mo.	1	sound	1	2 mo.
PARAFFINE II.—Applied hot to heated briquette. Penetrated ⅛ in. Oils dissolved paraffine in 1½ mo.																
Sept., 1904	Stone and clay	14 da.	....	14 da.	....	1 da.	28 da.	4 mo.	1	sound	1	2 mo.	1	sound	1	2 mo.
Sept., 1904	Marl and clay	14 da.	....	14 da.	....	1 da.	28 da.	4 mo.	1	sound	1	2 mo.	1	sound	1	2 mo.
Sept., 1904	Slag and stone	14 da.	....	14 da.	....	1 da.	28 da.	4 mo.	1	sound	1	2 mo.	1	sound	1	2 mo.
SODIUM SILICATE.—Oils dissolved sodium silicate coating in 20 days.																
Dec., 1904	Stone and clay	14 da.	7 da.	....	....	7 da.	21 da.	1½ mo.	1	sound	1	sound	1	sound	1	sound
Dec., 1904	Slag and stone	14 da.	7 da.	....	....	7 da.	21 da.	1½ mo.	1	sound	1	sound	1	43 da.	1	sound
Regular briquettes to accompany above.																
Dec., 1904	Stone and clay	14 da.	7 da.	....	....	....	21 da.	1½ mo.	1	sound	1	sound	1	sound	1	sound
Dec., 1904	Slag and stone	14 da.	7 da.	....	....	....	21 da.	1½ mo.	1	sound	1	sound		43 da.	1	25 da.
Grand total briquettes, 84.							Total briquettes,		21		21		21		21	

briquettes broke about 20 per cent. below the untreated, which weakening is contrary to what has been claimed for it. Photograph 8 shows briquettes which were made according to this process, and after 14 days old, treated for six months with extract of lard oil. Photograph 9 shows briquettes of the same series which were made in the regular way. Photographs 10 and 11 are similar except that signal oil was used in place of extract of lard.

We next experimented with paraffine, because there are few things that attack it, including all acids and alkalies. I believe that the obelisk in Central Park, New York, was treated with it to prevent weathering. Part of the briquettes were coated with it on the outside by dipping them in hot paraffine, and other briquettes were heated and held in hot paraffine until they became penetrated ⅛ in. Neither of these experiments apparently prolonged the time before disintegration by oils. The results were a great disappointment.

Sodium silicate, or what is known as water glass, was the last tried. This is a fire-proof oil or varnish, and is sometimes used to prevent stone from weathering. This coating was dissolved in 20 days. One of the briquettes has been disintegrated although the oil has been applied for only about 1½ months.

Table 2 covers the tests on the briquettes which were treated to preserve them from the effects of oil. A study of it will reveal more than has been pointed out in the paper. It contains full information about all of these tests.

The difficulty experienced in finding a cheap wash that will absolutely protect concrete from oil is apparent. Something is wanted that will penetrate into the concrete to allow for wear, and most of all be inexpensive. This paper ought to bring the matter to the attention of engineers and concrete users, and start further investigations along these same lines, or at least bring out suggestions that can be tried in established laboratories. Let us hope that the time is near when it will not be necessary to use brick facing and stone caps for massive concrete exposed to oil, or in the absense of these feel uneasy about the final character of the concrete. Moreover, we do not want to limit the use of reinforced concrete to those places where there is no oil.

In closing I wish to say that we greatly appreciate the work of our cement tester, Mr. George J. Griesenauer, in furthering these investigations.

Pumping the Comstock Lode Mines.

By Carl George P. de Laval.

For years numerous efforts have been made to unwater and explore the entire Comstock Lode. The latest move in this direction has just been made by the Ward Shaft Association, consisting of a group of the middle mines, composed of Gould & Curry, Savage, Chollar, Potosi, Bullion, Alpha Consolidated, Exchequer, and the Julia Consolidated Mining Co., who own and operate nearly a mile of the middle lode. This association, through its chief engineer, Mr. Leon M. Hall, has recently placed an important contract for a permanent pumping installation.

It is now about 26 years since the largest pumps of the steam-actuated type were installed in these mines, but since then science has progressed in the development of pumping appliances to such an extent that it would be an injustice to criticise the types that were then in use, comparing them with modern up-to-date equipments. Moreover, the reasons and causes for adopting the types then in use are now forgotten. Suffice to say, it is with admiration that we look upon the great efforts and successful designs that were applied in former years by the veteran engineer, Mr. W. R. Eckart, of San Francisco, before the completion of the Sutro tunnel.

The responsibility of successfully demonstrating that the later types of pumps will accomplish the exploration of the southern portion below the 2500-ft. level has fallen on the shoulders of Mr. Hall. The northern half has already reached a depth of 3000 ft., with very good returns from the deepest parts, and there are known to be large mineralized bodies below the 2500-ft. level in the middle and southern parts, where the inrush of water about 20 years ago flooded all the middle mines up to the 1600-ft. Sutro tunnel level. All these levels have been idle, and it is Mr. Hall's belief that it is possible to unwater, ventilate and successfully and safely work the levels as deep as 5,000 ft.

No known mining district in the world has encountered greater difficulties than the Comstock has met, or will meet in handling successfully the various problems. The water that was encountered 20 years ago on the 2,900-ft. level of Exchequer Mine in Gold Hill, was 170° Fahr. in temperature, and the temperature of the station and workings about 110°. After various efforts to handle this inrush of water it was finally decided to allow the water to fill to the Sutro tunnel. About ten years ago another effort was made to unwater the mines through the Crown Point incline, which also was abandoned after an expenditure of about half a million dollars, and future workings were confined to the 1,500-ft. level.

At this time hydraulic pumping engines were installed, together with various Cornish engines, altogether of a capacity to keep the water at the 3,300-ft level in the northern mines, but the expense of operating them was so great that the mines were allowed to fill up to the 1,600-ft. level and workings were confined to the more accessible ore bodies about the Sutro tunnel. The fact that the deposits which have been worked at the higher levels continue at the lower levels has induced the mining companies to try every known expedient in order to reach them. Therefore, about four years ago a large hydraulic lift was installed at the Consolidated California shaft, and with this appliance the water level in the north end has been kept below the Sutro tunnel level at about 2,150 ft., and a considerable amount of valuable ore has been taken out, amounting to over $1,000,000. Having reached this level another effort was made to go lower, installing an electric pumping plant of the most modern type, consisting of three Riedler electric pumping engines driven by 200-h.p. induction motors. These pumps take the water at the 2,150-ft. level and, together, discharge 4,500 gal. per minute into the Sutro tunnel under 430-ft. head. The hydraulic pumping engine serves as a sinking pump, discharging into a tank at the Riedler pump.

The application of electricity on the Comstock, not only in pumping but in hoisting and for general use in mining, was introduced about four years ago by Mr. Hall. The power is generated on the Truckee River, about two miles east of Floriston, where McCormick turbines are direct-connected to Westinghouse three-phase generators of the revolving armature type. Each pair of wheels will develop about 1,400 h.p. under a head of 84½ ft. Regulation is effected by Lombard governors. The generator potential of 500 volts is raised to 24,000 volts by Westinghouse oil-insulated transformers and the current is transmitted about 35 miles to Virginia City over a double circuit of copper wire. The mining companies purchase power from the Truckee River General Electric Co., the amount used being based upon a peak load of two minutes' duration when the electric hoists are operated directly upon the lines. The price is $7 per horse-power per month. There is about 2,000 h.p. of apparatus installed the Comstock Lode, which will soon be increase to about 5,000 h.p., as a contract has lately be closed between the Truckee River General Ele tric Co. and the 32 mining companies comprisi the Comstock Pumping Association, which cal for the delivery of electric power for draini the Comstock mines, lighting, hoisting, etc., th maximum amount being 5,000 h.p. In order fill these contracts for additional power th Truckee River Co. has prepared plans for a sec ond electric generating station and a new po line. Water will be diverted from the Trucke River and conducted to the extreme eastern en of the company's hydraulic system, where it wi be utilized by water wheels under a head of 14 ft. For the maximum of 5,000 h.p. the rate wi be $4.50 per horse-power per month, with propor tional rates for lesser amounts. This is based upo motor readings and will save the mining com panies a considerable amount of money as com pared with the existing contract. All motor of 50 h.p. and over are operated directly on 2,24 volts, all smaller motors on 440 volts, and th lighting circuit is 220 volts, three-wire system except in the Gould & Curry mine, where it is 110 volts.

The ventilation in the mines is of the best, as it must be owing to the excessive heat and saturation from hot water. Most of the ventilation is of the natural type through various shafts on the different levels. The cold air is forced by electric fans to the different headings and sections.

The electric hoisting machines are of Mr. Hall's design, and the most complete, satisfactory and economical that can be found utilizing the balanced or tail-rope system of hoisting.

The reason for installing the Riedler pumps at the C. & C. shaft in 1902 was the inability to go any farther than 450 ft. below the Sutro tunnel level with the power from the hydraulic water supply for the hydraulic elevators, which proved most practical sinking pumps. Although the efficiency is only 25 per cent., the cost of repairs is small and this type of sinking pump is fully as reliable as any other appliance for this purpose.

The Riedler electric pumping plant handles not only the mine water, but also the pressure water when the hydraulic elevators are used for sinking. However, when the shaft is free from water another pumping plant is to be placed at the 2,550-ft. level, abandoning entirely the use of the hydraulic elevators.

The Riedler pumps are of the mechanically-operated valve type and run at 110 r.p.m. Their gear accomplished its object for high speed when first introduced, but, of those pumps that have been fitted with it, in many instances the positive valve gear has been removed and the pumps have been operated with equally good success without the gear. An instance of this is a pumping engine designed by the writer having positively closed valves and running at a speed of 600 ft. a minute, and from which the gear was removed for an experiment to determine the capability of the engine running at the same rate of speed without the positive valve gear. Since the removal of the valve gear the pump has been running three years with a very slight alteration in the arrangement of the valves themselves. The results have conclusively proved that high-speed pumps do not require positively closed valves and that such valves cannot be operated at more than 130 to 150 r.p.m., while properly constructed poppet valves are operating at as high as 300 r.p.m. without showing the defects natural to poppet valves. Various engines have been designed by the writer and are now running at 600 to 800 ft. without a positive mechanism, showing that water hammer from backward flow at the end of the stroke, which causes valves to seat hard, be removed without the application of me- nically-moved valves, if the pump is properly portioned in relation to water spaces, air mbers and passages. Some designers advocate chanically closing both inlet and outlet valves, le others favor mechanical opening. Again he constructors mechanically operate but one of valves. Such mechanisms are useless and d only to trouble and expense. Simplicity, as as possible, is a desirable feature in all con- uction.

In determining the type and design for the ard shaft, the association was able to select the ant from the best types of pumping machinery the world, and to consider the electric motor d pumping machine as a whole unit. It is a ell-known fact that motors designed for such ow speeds as 100 r.p.m. will give a very low ower factor and that one of the same capacity nning at 200 r.p.m. would give about 15 to 20 r cent. better results as regards the amount of ower saved at the generating station and the duced cost for operating, and on this basis gh-speed 200 r.p.m. pumps without mechanically perated valves were selected.

The International Steam Pump Co. was rep- esented by Messrs. Charles C. Moore & Co., ngineers, its Pacific Coast agents, and the riter, who went to Virginia City especially to nvestigate carefully the situation at the Comstock Lode. Mr. Hall conducted negotiations or the Ward Shaft Association. The contract alls for two first-motion electrically-driven umps, each of the units to have capacity for ifting 1,600 gal. of water per minute against a pressure equivalent to a height of 1,500 ft., or rom the 3,000-ft. level up to the level of the outh lateral branch of the Sutro tunnel.

Each pump is to be driven by an 800-h.p., slow-speed, induction motor. The contract includes column pipe, traveling crane for the pumping station, automatic oil system, a small air compressor for filling the air chambers, a small vacuum pump operated by compressed air for discharging air from the suction chamber, all the piping, valves of every description for completing the installation, and a complete set of duplicate parts of the pump.

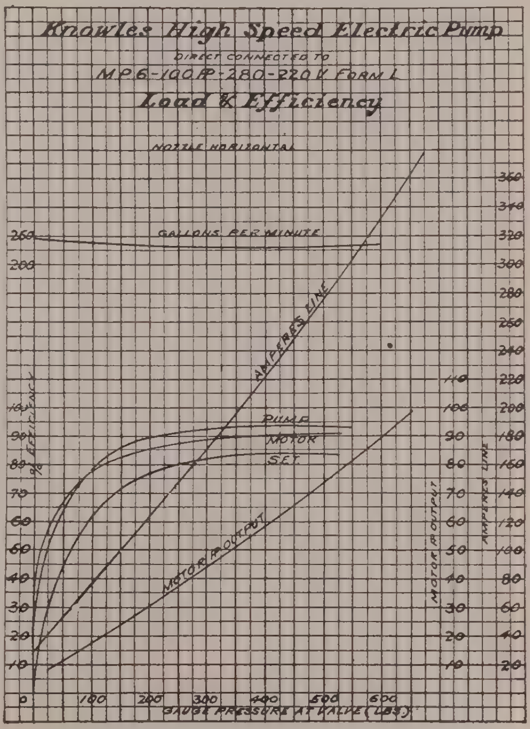
It is intended to install a temporary drainage plant at the Ward shaft, first using an air lift to lower the water to the 1,800-ft. level and thence down to the 2,500-ft. level without other pumps. The present bottom of the shaft is at the 2,500-ft. level, and when that point is reached the shaft will be sunk through the solid rock to the 3,000-ft. level, where the permanent pumps just contracted for will be installed.

Pumps of the type selected for this shaft are built in capacities from 200 to 4,000 gal. per minute, and for heads from 100 to 2,000 ft. The weight of both pumps for the Ward shaft and their motors is about 600,000 lb., which may be interesting for comparison with the older pumps at the Comstock.

The Ward shaft electric pumps will have a capacity of 3,200 gal. against 1,500-ft. head and will cost $80,000. The Mexican Union pumping engine is a Cornish type compound, condensing, fly-wheel, Leavitt arrangement of cylinders, with a fly-wheel 36 ft. in diameter, which, with its shaft alone, weighs 208,700 lb. The high-pressure cylinder is 64 in. in diameter by 6 ft. 9 in. stroke, and the low-pressure cylinder, 100 in. in diameter by 8 ft. 6 in. stroke. The nominal stroke of the pump is 10 ft. This engine was constructed in 1880, with a double line of 14-in. plunger pumps, discharging into the Sutro tunnel. Later the 14-in. pumps were replaced by 17-in. and additional 18-in. pump rods were added about 1,000 ft. long. The pump rods, from the top bob to the 2,700-ft. level, were 2,618 ft. long. The total weight of moving parts was 1,620,500 lb. The total lift of water was 1,180 ft. to Sutro tunnel from the 2,700-ft. level station. Due to the great length of pump rods, the effective stroke of the plungers was reduced from the surface stroke of 10 ft. to an actual stroke of 9.7 ft.

The Chollar, Norcross, Savage, Belcher and Overman pumping engines were all of the compound, vertical, condensing Davey type. The high-pressure cylinders were 32 in. in diameter, the stroke 10 ft. 9 in., and the low-pressure cylinders 65 in. in diameter and 8 ft. stroke. No fly-wheels are used on this type and the strokes are variable, as in any direct-acting pumping engine. These pumps force water from the 3,180-ft. level to the Sutro tunnel, 1,570 ft. The total weight of the moving parts is 1,437,900 lb.

In the underground station cuts at the 2,400, 2,600 and 3,000-ft. levels hydraulic pumping engines were used. The ratio of power plungers to pump plungers was proportioned so that the pumps could make six to seven strokes per minute.



Characteristics of New Pumps for Comstock Lode.

In the Yellow Jacket shaft a pump was installed in 1880, which at that time was considered the best of any. The type of engine was a horizontal compound fly-wheel design, the high-pressure cylinder being 31 in. in diameter; and the low pressure cylinder, 62 in. The balance bob was so constructed that the pump cylinders would receive a 10-ft. stroke. This pumping engine took water from the 3,000-ft. level, pumping it direct to the surface, having a total length of pump rods of 3,055 ft. The weight of the moving parts was 1,510,400 lb., and the engine made 5½ r.p.m. when pumping 432 gal. An accident occurred to this engine, causing it to be closed down until the Sutro tunnel was completed, when it was replaced by a double line of pumps raising the water 1,516 ft. to the Sutro tunnel and pumping 700 gal. per minute. About a month later a heavy flow of water from the 2,700-ft. level of the Exchequer mine was encountered, flooding all the low levels. The pump was speeded up to its utmost capacity, 750 gal. per minute, but the water still gained and the pump was not able to hold it, nor could any other means at hand control the water. It was then stopped entirely and for good.

In the Ophir mine the horizontal geared type of engine was used, the steam cylinder being 24 in. in diameter, with 5 ft. stroke, the pump being fitted with two fly-wheels. The pump stroke was at the surface 8 ft. and 7.7 ft. below. The total length of the pump rods (partly on the incline) was 3,273 ft., the weight of moving parts, 1,067,500 lb., and the water was pumped 900 ft. to the Sutro tunnel, discharging 280 gal. per minute.

At the Consolidated California shaft the engine was of the Davey differential type, the high-pressure cylinder being 24 in. in diameter, the low-pressure cylinder 40 in., with an 8-ft. stroke and 7-ft. stroke for the pumps. The pumps could furnish 500 gal. per minute, and the weight of the moving parts was 860,000 lb., with 2,150 ft. of pump rods. These pumping engines cost, without foundations and installation, $1,300,000, giving maximum capacity for all of 5,400 gal. to an average height of 1,152 ft. The average cost for operating was about $34 per indicated horse-power per month. The water pumped was 5,040 gal. to an average of 1,074 ft., with a total indicated horse-power of 1,703. The total cost per month was $58,120 or $697,440 per year, not including repairs, like a broken bob, wheels, plates, rods, plungers, etc. The hydraulic pumps handled 2,128 gal. per minute, and the Cornish 2,912 gal., requiring about 2.7 miles of rods, which, together with all other moving parts, came to the grand total of 6,496,400 lb. of reciprocating details requiring to be started and stopped nine times every minute. It therefore required 2,230 lb. of moving parts for every gallon pumped. These figures are given for comparison with modern high-speed engines with small parts of light weight, as there are no heavy moving parts in direct-connected pumping engines, which give at once the most flexible system, accommodating themselves to any size of installation. Great weights in motion limit speed, and the strength of materials is soon exceeded, causing breakdowns and repairs. The old Comstock pumps could not be increased in capacity, as extra weight brought reduction of speed, as was shown at the Mexican Union, where the speed had to be reduced to about 4 r.p.m. on account of overstraining the rods, which were of 18x18-in. Oregon pine and 2,618 ft. in length. Owing to the extreme hot water (170°) and the saturated atmosphere of the shafts, the machinery and parts had to be constantly lubricated to an excessive extent, requiring careful watching for rotting of pump rods, rusting of wrought parts and destruction. The cost of maintenance and power was enormous, and could not continue with the advent of new methods and devices and the demands of shareholders for more dividends. When the C. & C. electric pumps were started a new era dawned upon the Comstock Lode, which will be followed up by the installation of the permanent Knowles electric "express" pumping engine just contracted for, draining the group of the middle mines upon the Comstock Lode to a depth of 3,000 ft. through the Ward Shaft.

The awakening of Comstock is now a matter of fact, and if statistics are to be relied upon the mineral deposits of this famous and marvelous camp have not yet been uncovered, many a fortune is still in store for our children, and history will be written of soul-stirring events. Again the rugged slopes of Mt. Davidson will be clustered by mines, with Virginia City thriving and prospering under permanent conditions. The only hindrance to progress has been the water, a problem which is now solved.

The Kingsland Shops of the Delaware, Lackawanna & Western R. R.

The passenger coach and locomotive shops now in course of construction at Kingsland, N. J., for the Delaware, Lackawanna & Western R. R., will call for an approximate expenditure of $1,000,000 when completed and equipped. The buildings have brick sidewalls and concrete-slab roofs supported on steel trusses. They are being built by the forces of the company, with the exception of the brick laying and the concrete roof. The steelwork is being fabricated by the McClintic-Marshall Construction Co., of Pittsburg, but will be erected by the company forces.

The paint and coach shop, 170 ft. wide by 660 ft. long, with a 50x268-ft. ell at the paint shop end, is the largest in the group, and its construction is the furthest advanced. This building has a truck shop across one end in which car trucks will be overhauled and trued up. An electric crane traveling the length of this shop will be used in handling the trucks, and the crane runway will be supported by steel columns in the walls.

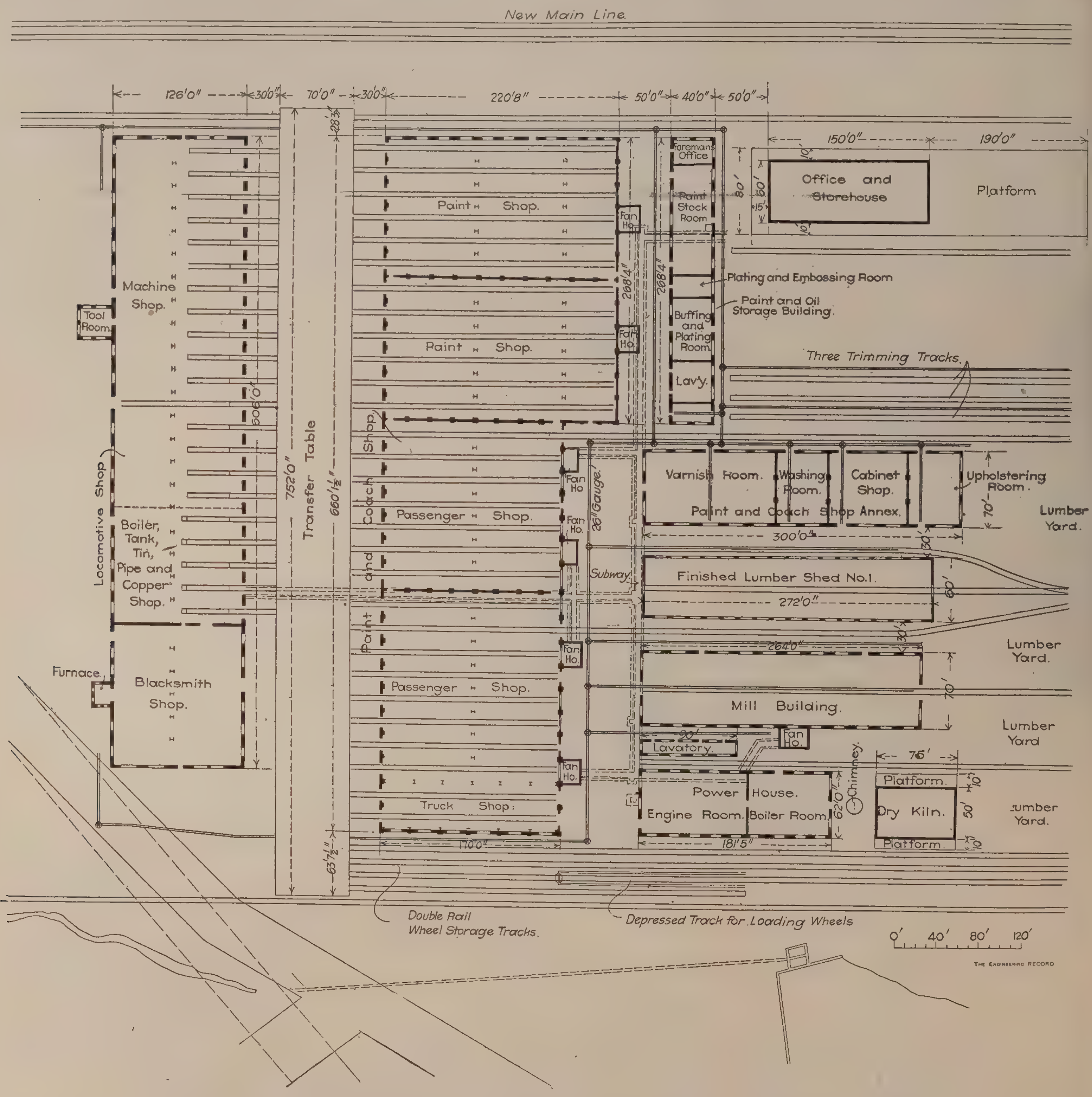
The locomotive shop, 126 ft. wide by 608 ft. long is the next largest building, and will be separated from the paint and coach shop by a space 130 ft. wide, in which a 70x752-ft. electric transfer table will be operated to serve both buildings.

The paint and coach shop annex, 70x300 ft. in plan, will be divided into a varnish room, a washing room, a cabinet shop and the upholstery department. The division walls will be of fire-proof construction, and the openings in them fitted with fireproof doors. All car trimmings will be prepared in this building, and then passed to the trimming tracks built along one side of it.

The paint and oil storage building will be 40 ft. wide by 268 ft. long, and will be divided to contain a cushion cleaning and dyeing room, a buffing and plating room, and embossing and plating room, a paint stockroom and an office for the general foreman and his staff. This building will have a 40x80-ft. basement for the storage of oils, etc. and is conveniently located in the rear of the paint shop, with which it is connected by a covered passage.

The 70x264-ft. mill building will contain in one large room all the wood-working machinery. An exhaust system will transport the shavings directly from the machinery into the boiler furnaces in the power house. Between the mill building and the paint and coach shop annex will be erected a 60x256-ft. lumber shed of fireproof construction.

The power house will be 62 ft. wide and 180 ft. long, with a 62x80-ft. boiler room containing six boilers, having a total capacity of 1,400 h.p. The boilers are to be set singly, three in a row on each side of the center, with the firing ends of the two rows facing and a coal bunker and conveyor overhead between them. The ashes will be removed in a tunnel directly under the ash pits of the furnaces. One-yard ash cars will be operated on loose trucks on a dolly track in the tunnel, which leads to a pit outside the building, where the car bodies will be hoisted and their contents automatically dumped into gondola cars by a pneumatic lift mounted on a small truck on wheels on an adjoining parallel track. The smoke stack of the power house will be of hollow brick



General Arrangement of the Car and Locomotive Shops of the Delaware, Lackawanna & Western Railroad at Kingsland, N. J.

nstruction, and will be connected to the boiler naces by an underground smoke duct. It will 90 in. in diameter at the top and 150 ft. high. Beside the buildings enumerated, for which the ns are nearly completed and several of which e under construction, there will be a two-story ice and storage building, 60x150 ft. in plan, with 80x190-ft. covered platform at one end; a 50x -ft. dry-kiln; several lavatory buildings, scrap ns, steel and iron racks, coke and coal storage ns and other auxiliary buildings.

A subway, 5 ft. wide and 6 ft. high, will conect the various buildings with the power house. his subway will contain all pipes connected with e shops, a special duct in the floor to carry the ompressed air pipes, and a shelf built in one wall or the electric cables.

The paint room of the paint and coach shop will e heated by indirect radiation, and will be proided with a ventilating system which is designed o change the air about five times per hour, thus acilitating the drying of paint and varnish work. The coach and truck shops of the paint and coach shop, the locomotive shop and the mill building will be heated by the overhead fan system of hot air, and all other buildings will be heated by direct radiation with coils on the walls. All power piping, high and low pressure steam piping, etc., will be done by company forces. The fans and connections for the blower or hot air system and for the shaving exhaust system will be furnished by contract.

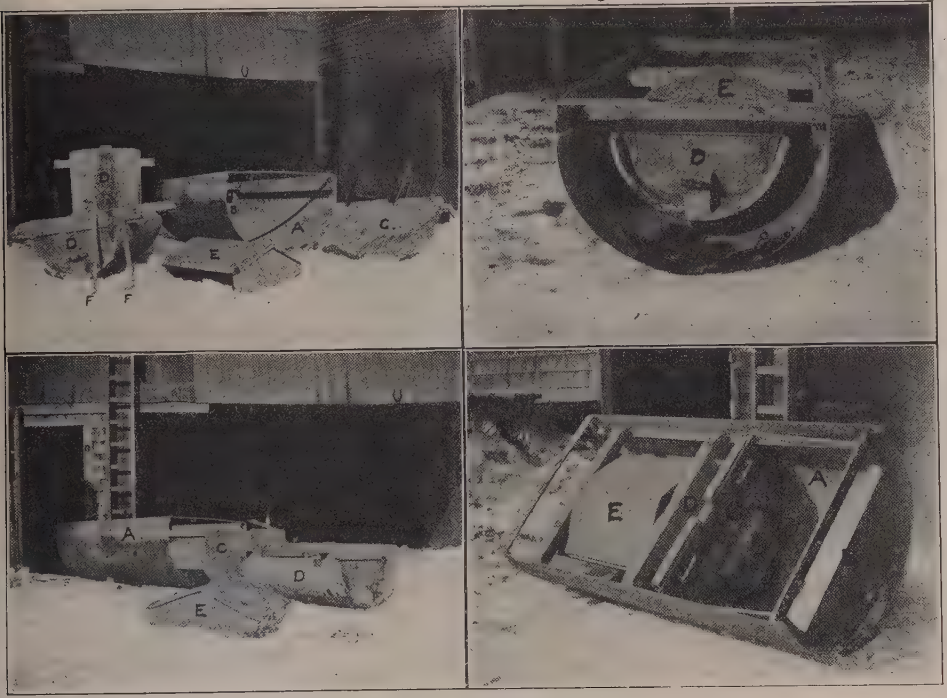
The plans for this work were made under the direction of Mr. L. Bush, chief engineer, by Mr. Frank J. Nies, the company architect. The construction work is in charge of Mr. E. I. Cantine, division engineer of the Morris & Essex division, and the carpentry and mill work is being taken care of by Mr. J. E. Snell, superintendent of buildings and docks. Mr. F. L. Wheaton, assistant engineer, has direct charge of the work in the field. Mr. R. F. Kilpatrick, superintendent of motive power and equipment, has charge of all equipment for the buildings, and will be in charge of the shops when they are completed.

THE STEEL SMOKE STACK which serves the boilers of the mechanical plant of the office building of the Penn Mutual Life Insurance Co., Boston is 140 ft. high and, according to the "Electrical World and Engineer," is lined with fire brick.

A Movable Form for Concrete Sewers.

By Robert R. Evans, City Engineer, Haverhill, Mass.

The traveling form used during the past year in constructing the inverts of concrete sewers in Haverhill was a modification of one used during the previous year, and the motive for the construction of the original form was as follows: A 30-in. circular sewer was to be built in a section of the city where it was known that a loose gravel, suitable for concrete, would be encountered for the full depth of the trench, which varied between 12 and 14 ft. The presence of this gravel made the use of concrete especially desirable, but it was thought that its loose nature would cause it to cave off from the sides of the trench and fall beneath the forms, if of the ordinary pattern, before the concrete could be deposited. On the other hand, to sheet the trench to the bottom, and fill the entire space with concrete, would require an excess of material. Accordingly, a form was devised by the writer, in which a steel shell of quarter-inch plate, bent to the desired shape of the outside of the concrete section, was used to support the excavation, and to retain the concrete, and was forced ahead by a jack, a short distance at a time, as fast as the concrete was deposited.



Form Used for Concrete Sewer Inverts at Haverhill.

The successful use of this form led the writer to design another to accomplish the same end, but with some changes in form of construction which use had suggested to him, and this was used during the past season for the construction of the invert of a 24-in. sewer in a locality where, for the greater part of its length, the bottom might have been excavated to the desired section and ordinary forms used. Briefly described, this latter form was made as follows:

A plate of steel ¼ in. thick and 6 ft. 2 in. long, was bent to a semi-cylinder with an inside radius of 18 in., and the sides extended on a tangent to the curve, about 6 in. above the plane of the horizontal diameter. The front open end was stiffened by a curved 3-in. angle iron riveted to it, with a horizontal angle iron riveted across its upper ends, while the rear open end was held apart by a 2x½ in. iron bent down at the ends, and riveted to the inside of the steel plate near its top edges. Along the inside of the shell thus formed, longitudinal 1½-in. angle irons were riveted with the horizontal leg up, and 1½ in. above the horizontal diameter. These angle irons served as tracks, or ways, for the support of the inside, or core, forms. The inside forms were made in 3-ft. lengths, and consisted of two ribs made of 2-in. plank, to which narrow strips of wood were nailed, forming a semi-cylinder, which was covered with sheet iron.

To facilitate lifting these forms out of the concrete, their upper edges were spread about ¼ in. from a true semi-circle. Along the inside bottom of each form, a 4x6 in. timber extended from end to end, passing through the ribs, which were fastened to it, and a projection on the top of this timber, at the rear end of the form, prevented the front end of the following form from lifting above it.

When all the forms were in place this timber formed a continuous column for their entire length, against which the jack reacted in forcing ahead the outer form. Across the top of each rib a 3x3-in. oak timber was fastened, projecting 6 in. beyond the sides of the inner form, at such a height that, when this inner form was dropped into the steel shell, it was held suspended concentrically within the outer form, leaving an annular space of 6 in. in which to place the concrete. It will be readily seen that the inner form was then free to slide out at the rear end of the outer form, while still retaining its concentric position in relation to it.

A partition of 3-in. plank fastened to the back of the curved angle iron in the forward end of the outer form, to which was bolted the base of an ordinary track jack, and a second, movable partition to receive the thrust of the head of the jack, and made of two layers of 3-in. plank, fitting loosely in the outer form, and hung from a cross bar sliding on the longitudinal ways, completed the essential parts of the outfit.

In use the outer form was placed in the trench which has been excavated to the proper depth, and set to the line and grade. One of the inner forms was then dropped in, resting on the ways, and the movable partition brought against the forward end of this inner form, and held there by slightly tightening the jack. Concrete was then deposited in the annular space between the two forms, and rammed by a curved iron rammer. The jack was then brought into action and, with its base bolted, as previously stated ,to the forward partition fixed in the outer form, and its head reacting against the movable partition which in turn reacted against the ends of the forward inner form and of the newly made concrete section, forced the outer form ahead.

When starting the work it was manifestly necessary that either the concrete be abutted against the end of the trench or some other unyielding surface at the open end of the form, or the inner form be braced against movement; but after a few feet of invert had been completed it was found best not to provide any bracing to prevent movement of the inner forms, in order that the pressure, being thus borne by the concrete alone, would force the concrete into any depressions which might occur. A second ramming of the concrete, as the rear end of the outer form passed from under it, practically prevented any movement of the inner forms and forced the concrete into any such voids, but under favorable conditions the movement was so slight that even this precaution was not necessary.

As the jack used on this work would open only about 9 in., it was necessary to use three blocks 9, 18 and 27 in. in length, in order to get the forward movement of 3 ft. necessary, before another form could be inserted. The movable partition was, of course, pulled ahead before inserting a second inner form. Eight of the inner forms were used, giving a total length of 24 ft., and when all had been put in place, the rear one was brought forward as needed.

A simple clamp, consisting of a bent rod passing over the projecting supports of the inner form, and hooking beneath the angle iron ways, was used on each side to prevent the inner form from rising when the concrete was rammed beneath it; and to facilitate the placing of the concrete, a pitch roof, covered with iron, was placed over the forward inner form, and the concrete, being dumped on this roof, either slid or was easily pushed into place by the rammer.

The various parts of the form are shown in the accompanying illustrations, on each of which the parts are designated as follows: A, outer form; B, fixed partition in forward end of outer form, furnishing bearing for the base of the jack; C, movable partition; D, inner forms, only two of which are shown; E, roof used on forward inner form to facilitate spreading concrete; F, bent rods, or clamps, to hold down inner forms. In the illustrations, that in the upper left-hand corner shows the various parts of the forms separately, the lower left-hand cut shows them arranged in the order in which they are to be assembled, and the others show the parts assembled, ready for use, the upper one being a view from the rear, and the other from the forward end. The clamps are shown in the first view only, as their use is apparent, and they are too small to show effectively in the photograph. The jack, which as before stated, was an ordinary track jack, was not available for the photographs, but the last-mentioned illustration shows very plainly the space which it would occupy between B and C.

An ordinary level was used on the forward end of the outer form, to assist in keeping it level transversely.

Two men managed the forms, one alternately ramming the concrete into place and working the jack, while the other assisted in bringing up the forms from the rear, and shaped out the trench just ahead of the form, practically one-half the time of each being consumed in moving the forms.

For the concrete, the small or nut size of broken stone from the city quarry was used in the proportion of 1:3:5. A mixture was used, wet enough so that when placed in the space on one side only of the form, it could be easily forced up on the other side by the rammer.

No especial difficulty was experienced in keeping the form to line and grade, with a good, straight trench and a little care in getting the form properly aligned at the start, and while one man worked the jack, the other, with a lever bearing under the forward end of the outer form, easily corrected any tendency to vary from line or grade, and kept it level transversely. As the grade of this particular sewer was 6.6 per cent., some precautions were not taken in this matter which would be necessary in flatter grades.

As the actual work of building sewers in this city is under the charge of the superintendent of highways and not of the engineering department, I am unable to give the itemized cost of the whole work, but from my own notes taken at the time, I find that the cost of the first piece of the sewer built with this form was as follows, it being understood that some delays occurred during the first day or two, on account of the unfamiliarity of the men with these forms.

Total length of concrete invert, 265 ft. Theoretic quantity of concrete in invert, 6 in. thick, 19.3 cu. yd. Total number of hours' labor, one man, mixing and placing concrete and setting and moving forms including trimming bottom of trench ahead of forms, 221 hours at 25 cents per hour, which is equivalent to $2.86 per cubic yard, or $0.21 per linear foot.

This cost was divided as follows: Labor setting and moving forms alone, 42 hours at 25 cents, or $0.67 per yard, or $0.05 per linear foot, leaving the balance of $2.19 per yard, or $0.16 per linear foot, as the cost of mixing, wheeling and placing concrete, including some trimming of the trench, and washing over the completed section with neat cement.

The bottom of the trench on this portion of the work was hard and full of rocks and required to be excavated slightly larger than the outside from, the space being filled in with gravel tamped in from the forward end.

When this tamping and filling with gravel was carefully done, the amount of concrete used could not, of course, be in excess of that necessary to form a 6-in. half ring, but as the work was done by the day there was a tendency to omit to carry the gravel up to the full height of the concrete, and these side spaces were filled by the addition of concrete at the time of tamping behind the form, previously referred to, as this was easier. Even in these portions of the work, however, which were particularly unfavorable to this style of form, there was less concrete used than would have been the case with the ordinary forms, provided the walls had been made nowhere less than the required 6 in.

The advantages of a form such as that described, are of course, greatest in loose material which would, with ordinary forms, necessitate the use of more concrete, but aside from this consideration, there seems to be a better opportunity to ram the concrete, as the outer form guides the rammer beneath the inner form, the concrete being rammed is confined at both ends, and finally the pressure exerted in forcing the outer form ahead tends to consolidate the concrete in a direction at right angles to the direction of ramming.

An unscrupulous workman cannot reduce the thickness of the wall to save work, and only a short section 3 ft. in length, in the form above described, is exposed to the falling of material between the forms, and even should this occur, it is the work of but a few moments to take up the forward section of the inner form, remove the obstruction, and replace the section.

No reinforcement was used on the work described, but should it be desired, there would seem to be nothing to hinder its use, the circumferential reinforcement being held in place, either on the inner or outer form before placing the inner form, and by providing holes in both partitions wherever longitudinal reinforcement might be required, rods of any length could be used.

Steps have been taken toward securing a patent on some of the features of the above form which are thought to be novel.

Letters to the Editor

Areas of Circular Segments.

Sir:—A very simple rule for ascertaining the areas of circular segments is the following: Area is equal to two-thirds of the product of the chord and center height of the segment, plus a fraction having the cube of the center height for the numerator and twice the chord for the denominator.

In the example given in Mr. Bleich's letter in your issue of February 18, the chord was 3.96 and the center ordinate 1.5. The above formula becomes in this case:

$$\frac{2 \times 3.96 \times 1.5}{3} + \frac{1.5^3}{2 \times 3.96} = 4.386.$$

The above rule is quite as simple as the Verein Hütte tables referred to, and vastly more so than calculating in the regular way, even with a table of areas of segments of circles.

J. A. Macdonald.

Hermanville, P. E. I.

Lengths of Circular Arcs.

Sir:—In the issue of February 18 a table of areas of circular segments appeared. Its companion table of lengths of circular arcs is herewith enclosed. For convenience of interpolation, the differences of the successive value of c are given. An inspection will show that the second differences are small; consequently, by the ordinary method of interpolation by first differences, a very reliable value for c is obtained.

To obtain the length of a circular arc, when the chord and mid-ordinate are known, divide the mid-ordinate by the chord and for this ratio select from the table the corresponding value of c. Multiply the chord by c to obtain the length of arc. For a chord of 15 ft. and a rise of 2.3 ft., $r \div s = 2.3 \div 15 = 0.15\frac{1}{3}$. From the table the corresponding value of $c = 1.0617$ is obtained. The length of arc equals $1.0617 \times 15 = 15{,}925$ ft.

Sam'l D. Bleich.

New York, Feb. 25.

Lengths of Circular Arcs.

Chord or span $= s$.
Mid-ordinate or rise $= r$.
Length $= cs$.

r/s	c	r/s	c	r/s	c
.01	1.0000 11	.18	1.0843 94	.35	1.3000 160
.02	1.0011 16	.19	1.0937 98	.36	1.3160 163
.03	1.0027 20	.20	1.1035 102	.37	1.3323 166
.04	1.0047 24	.21	1.1137 107	.38	1.3489 170
.05	1.0071 29	.22	1.1244 111	.39	1.3659 173
.06	1.0100 34	.23	1.1355 116	.40	1.3832 176
.07	1.0134 38	.24	1.1471 120	.41	1.4008 179
.08	1.0172 43	.25	1.1591 124	.42	1.4187 182
.09	1.0215 50	.26	1.1715 128	.43	1.4369 184
.10	1.0265 55	.27	1.1843 132	.44	1.4553 187
.11	1.0320 60	.28	1.1975 135	.45	1.4740 190
.12	1.0380 65	.29	1.2110 139	.46	1.4930 192
.13	1.0445 70	.30	1.2249 143	.47	1.5122 194
.14	1.0515 75	.31	1.2392 147	.48	1.5316 195
.15	1.0590 80	.32	1.2539 150	.49	1.5511 197
.16	1.0670 84	.33	1.2689 154	.50	1.5708
.17	1.0754 89	.34	1.2843 157		

Perforated Manhole Covers.

Sir:—I was much interested in the article by Mr. Alexander Potter in The Engineering Record, of February 11, on the extent of infiltration through perforations in manhole covers—as on the dates mentioned, January 6 and 7, we had in Newton, Mass., exactly the same conditions of snow and warm rain. We have, in the village of Newton Upper Falls, a small area draining to a pumping station at which a constant automatic record of flow is kept. On this area there are 2,500 ft. of sewers and 13 manholes, none of the covers of which are perforated. The record showed that there entered for over an hour 30 gal. per minute of rain and melted snow. This was equivalent to a leakage around each cover of $2\frac{1}{3}$ gal. per min. This showed us that the ordinary cast-iron manhole cover, even if without any perforations, is far from water-tight unless calked or sealed in some special way.

In regard to plugging perforations, we have experimented a little with lead and have concluded that it is practicable to pour the holes with lead, or to upset or rivet in them lead plugs previously molded. This we propose to do as our sewers are provided almost entirely with perforated covers, and investigation has recently shown that ventilation is going on by means of the house connections when the manhole covers are sealed with closely packed snow.

Yours truly, J. H. Kimball.

West Newton, Feb. 28.

The Loss of Temperature of superheated steam in mains is liable to be overlooked by engineers accustomed only to saturated steam. Dr. Berner, of Berlin, has found that the drop in well-lagged pipes will range from 0.3° to 1° Fahr. per running foot. The drop varies inversely as the diameter and steam velocity.

CURRENT NEWS SUPPLEMENT

MARCH 25, 1905.

NATIONAL ENGINEERING SOCIETIES.

ETY OF CIVIL ENGINEERS. Sec-
rren Hunt, 220 West 57th St.,
ıal convention, Cleveland, June
ting, April 5.

ETY OF MECHANICAL ENGINEERS.
Hutton, 12 West 31st St., New
ting, New York, March 28, 8.15
Dr. Howard T. Barnes, of Mc-
on the formation of anchor and
ecise temperature measurements.

STITUTE OF ELECTRICAL ENGI-
y, Ralph W. Pope, 95 Liberty
Annual convention, Asheville,
23. Next meeting, at Carnegie
four papers on meter subjects.

STITUTE OF MINING ENGINEERS.
V. Raymond, 99 John St., New

STITUTE OF ARCHITECTS. Secre-
own, Washington, D. C.

OF ENGINEERING SOCIETIES. Sec-
C. Trautwine, Jr., 257 South
ladelphia, Pa.

OCIETY OF HEATING AND VENTI-
ERS. Secretary, W. M. Mackay,
New York.

CIETY OF CIVIL ENGINEERS. Sec-
H. McLeod, 877 Dorchester St.,

THE PROMOTION OF ENGINEERING
ecretary, Prof. M. S. Ketchum,
Colorado, Boulder, Colo.

OCIETY FOR TESTING MATERIALS.
f. Edgar Marburg, University
a, Philadelphia, Pa.

OCIETY OF MUNICIPAL IMPROVE-
ary, George W. Tillson, Room 12,
ding, Brooklyn, N. Y.

OF RAILWAY SUPERINTENDENTS OF
BUILDINGS. Secretary, S. F. Pat-
, N. H.

AILWAY ENGINEERING AND MAIN-
AY ASSOCIATION. Secretary, L. C.
Monadnock Block, Chicago.

WATER-WORKS ASSOCIATION. Sec-
Diven, Charleston, S. C.

FOUNDRYMEN'S ASSOCIATION. Sec-
Moldenke, P. O. Box 432, New

ILDERS' ASSOCIATION OF THE
. Secretary, J. L. Lyle, 39 Cort-
York.

ONAL MINING CONGRESS.

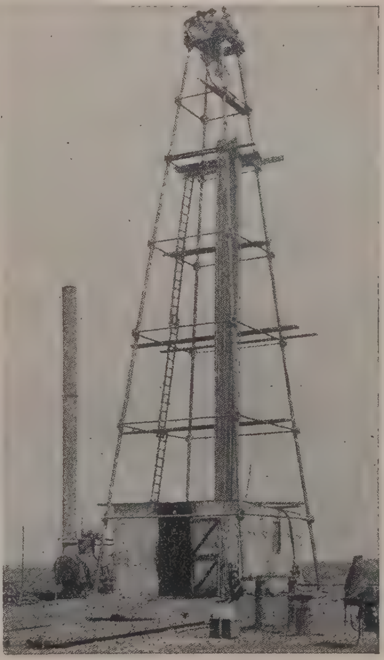
ional Mining Congress, which will
June 25 to July 1 of the current
e auspices of the Belgian govern-
ry on its work by general meet-
meetings, lectures and exhibits.
r membership should be addressed
treasurer of the organizing com-
Libert, 16 Quai de l'Université,
ee is $25 for the whole congress
y one of the four sections into
vention will be organized in ac-
the following program:

section: sinking deep shafts
rocks; winding engines and plant;
ng engines; air-compressors; re-
nents in timbering and gobbing;
easures consequent on coal work-
cal preparation of ore and coal;
ditions to be satisfied by electric
nification of official mineral statis-
allurgy section: utilization of non-
r making coke; study of the blast-
ence of foreign substances on pig-
l; methods for intercepting dust
nace gases with a view to their
g brick and cement; utilization of
a view to producing power for
ains; new methods for making
eel; special steels; forging by the
m-hammer, hardening and anneal-
etallurgy; metallography. (3) Me-
n: construction of engine parts;
stion motors; mechanical applica-
ricity; turbo-machines; steam engines and boilers; practical and economical conditions of motor-wagon construction and use. (4) Applied Geology section: tectonics of coal basins; sedimentary deposits; metalliferous lodes; hydrology.

DEEP DRILLING IN THE TRANSVAAL.

Diamond drilling as a means of locating the gold bearing reefs of the Transvaal, has been in general practice for many years. Unusual interest attaches to it at the present time, owing to the large number of deep holes which are being sunk to prove the existence and position of the ore bodies at increasing distances from the outcrop. For this work larger and larger drills have been used, and within the past year or two numerous bore holes have been bottomed in ore at depths of from 4,500 to 5,000 ft. Upward of 300 diamond drills are now in use in South Africa, many of the deep holes being sunk by the Sullivan improved Class P drill with a rated capacity of 4,000 ft.

The mining companies as a rule let the work to contractors, who furnish all the equipment and expert operators, and deliver the core into the hands of the company. American contractors have recently broken all records for depth. James Tobin completed a bore hole last December at Doornkloof, sixteen miles west of Randfontein, at a depth of 5,560 ft. This hole was sunk to prove the main reef series, and it is understood that the results are conclusive, although they have not been made public. The deflection was very slight. The first 3,200 ft. were bored with a Sullivan size N drill, having a rated capacity of 2,000 ft. A size P drill, with a rated capacity of 4,000 ft., was then put in commission and continued the hole until its completion at 5,560 ft.; 700 ft. of size N rods removing a 2-in. core were used, the remaining 4,860 ft. being B, removing a 1⅜-in. core. The total load of these rods was between 15 and 16 tons, which was handled by the engine without difficulty.



A TRANSVAAL WELL OUTFIT.

The actual running time of this hole was 14 months, or an average of nearly 400 ft. per month. For the first two months two ten-hour shifts were used, and for the balance of the time the work was carried on the whole 24 hours, divided into three eight-hour shifts. The rods were pulled in lengths of 50 ft., the height of the tubular steel derrick being 66 ft. over all. The time required to lower the rods at a depth of 5,000 ft. was from 3 to 3½ hours, and from 3½ to 4 hours was required to lift them.

This record has since been bettered by a hole sunk near Springs, east of Johannesburg, by John Skenke. This hole was begun May 1, 1904, and completed Feb. 2, 1905, at a depth of 5,582 ft. A size P drill was also used here, power being supplied by a 30 h.p. boiler; 1,000 ft. of E (2-in. core) rods were used, the remainder of the equipment being similar to that used by Tobin.

THE SAN PEDRO, LOS ANGELES & SALT LAKE R. R.

The San Pedro, Los Angeles & Salt Lake R. R., now nearing completion, is a short route via Los Angeles, between Salt Lake, and San Pedro, Cal., and also provides a connection between the transcontinental lines at Salt Lake and the harbor at San Pedro for a portion of the country heretofore without direct railroad facilities. The new road embraces an operating system of a little over 1,041 miles, 113 miles of which are operated under joint track agreement with other railroad systems, 577.6 miles are existing systems that have been acquired by the new road, and the remaining 350 miles are new. The old lines from Salt Lake to Caliente, in the southeastern part of Nevada, and from San Pedro to Riverside, Cal., have been largely reconstructed. From Riverside to San Bernardino, Cal., a joint track agreement has been made with the Southern Pacific Co., and between San Bernardino and Daggett, Cal., a similar agreement has been made with the Atchinson, Topeka & Santa Fe Ry. The connecting link between Daggett and Caliente includes the greatest part of the new construction, and provides transit facilities for a part of Nevada heretofore considered a desert, but now said to be rich in minerals and to be rapidly developing.

A considerable portion of the old line between Salt Lake and Caliente, which was acquired from the Oregon Short Line R. R., was laid with 52-lb. rails, and the roadbed was unusually narrow, ranging from 7 to 10 ft. in width. The light rails are now being replaced by 75-lb. sections, and eventually the whole line will be laid with rails of that weight, with 2,880 sawed ties to the mile. The roadbed is being increased to the standard width of 18 ft. on embankments and 20 ft. in cuts. The existing bridges were generally too light to carry the increased weight of the rolling stock, and 25 of them had to be entirely rebuilt and many others strengthened. A cut-off is being built on the old line a short distance south of Salt Lake, which will decrease the distance 16 miles and secure a line with easier grades and curves. Side tracks, with a standard length of 3,000 ft., have been placed, as nearly as possible, 5 miles apart, and water tanks have been located approximately 20 miles apart between Salt Lake and Caliente. Terminal yards and shops, with the usual facilities, have been provided at Caliente and at one other point midway between there and Salt Lake; the yards and terminal facilities of the Oregon Short Line R. R. being used under a joint track agreement in Salt Lake.

The construction of the connecting link between Caliente and Daggett required some heavy rock work near Caliente, followed by heavy grading to reach a plateau, from which the line crosses a desert, where no special difficulties were encountered, to a tunnel. Beyond this tunnel a succession of heavy rock work, fills, cuts and tunnels were required to complete the line into Daggett.

The road will be operated between Daggett and Riverside, Cal., under the joint trackage agreements mentiond. Entrance into Los Angeles is made over the old tracks of the Los Angeles Terminal R. R., which is now a part of the system. Several branch lines radiate from Los Angeles, but the main line runs to San Pedro harbor on the Pacific Ocean. Commodious passenger stations have been erected in the vicinity of Los Angeles and the road has been built with a view of handling a heavy local passenger traffic in this vicinity, as well as the through traffic.

The new work is now under the general supervision of Mr. E. G. Tilton, chief engineer, who was appointed in the summer of 1904. Prior to that time, Mr. Henry Hawgood was chief engineer and Mr. H. M. McCartney principal assistant engineer.

THE ARNOLD COMPANY.

Announcement is made of the change of name of the Arnold Electric Power Station Co., of Chicago, to The Arnold Co. This company was organized in 1896 by Mr. B. J. Arnold, primarily to build electrical power plants, but the scope of its work has gradually increased to include nearly all branches of electrical, civil and mechanical engineering and construction. The change of the name simply means the official adoption of the shorter title by which the company has been generally known among its friends. The company not only acts in the capacity of a consulting engineer for its clients, but also maintains a full construction organization for building the work it designs; at the same time, it keeps independent of any connection with manufacturing companies and is free to use the best apparatus for given conditions.

The fact that The Arnold Company are prepared to actually carry on the work of construction has an influence on their ability.

The company has been making a reputation in a number of different directions. In the electrical railroad field, it has been connected with the building of the Chicago & Milwaukee Electric R. R., the Chicago Electric Traction Co., the Lansing, St. Johns & St. Louis Electric Ry., the Kenosha Street Ry., the Bloomington, Pontiac & Joliet Electric Ry. and the Grand Rapids, Holland & Lake Michigan Electric Ry. Two of these are single-phase roads. Among the electric power stations which the company has designed and built are plants for Albert Dickinson & Co., Chicago and Minneapolis; Chicago Board of Trade; Chicago & Alton Ry., Springfield, Ill.; The Imperial Lighting Co., St. Louis; W. B. Conkey Co., Chicago; Land Title & Trust Bldg., Philadelphia; Otis Elevator Co., Chicago.

In the equipment of shops with light, heat, power, air and steam, the company has had active charge of work for the Chicago & Eastern Illinois R. R., the Chicago Great Western Ry., the Denver & Rio Grande R. R., the New York Central & Hudson River R. R., the Oregon Short Line Ry., the Père Marquette R. R., the St. Louis, Iron Mountain & Southern R. R., the Union Pacific Ry., and the Wisconsin Central R. R.

One of the latest developments of the company's work is designing and building of complete hydro-electric plants. An installation of 3,000 kw. capacity is about to be put in operation, with a 33,000-volt transmission line from the water power plant at Lowell, Kan., to the lead and zinc mines in the vicinity of Joplin, Mo. The company is a pioneer in high-tension transmission work for electric railways, having taken a contract for the first rotary converter system with a steam station in 1897. The company also had a contract for constructing the first single-phase railroad ever built; this contract was started in 1900.

The company recently increased its offices to accommodate its growing business, and now occupies Suite 1536-41 in the Marquette Bldg. The officers are: Bion J. Arnold, president; W. L. Arnold, vice-president; Ralph G. Arnold, secretary and treasurer, and George A. Damon, managing engineer.

A VERY LARGE PUMPING ENGINE.

The Board of Public Service, of Kansas City, Mo., has recently contracted for a new pumping engine, for the Turkey Creek pumping station in that city. The engine, which is to be of the vertical triple expansion type, will have a capacity of 20,000,000 gal. per day pumping against a domestic head of 340 ft. and a fire head of 410 ft. While neither the design nor capacity of the engine are unusual, yet, taken in connection with the high head pumped against and the moderate speed of operation, the engine becomes notable as being the largest water-works pumping engine in America, and perhaps in the world.

The steam cylinders are 40, 72 and 108 in. in diameter, by 66-in. stroke, the speed being 20 revolutions, or 220 ft. piston speed per minute. The guaranteed duty of the engine is 170,000,000 ft.-lbs., and the weight will be about 800 tons.

The engine will be constructed by The William Tod Co., of Youngstown, from the designs of Mr. Irving H. Reynolds, the consulting engineer for the company.

CENTRIFUGAL PUMPS AT WORKS OF THE SOLVAY PROCESS CO.

An interesting variety of De Laval centrifugal pumps, mostly driven by the De Laval steam turbine, but some direct connected to electric motors, have been installed at various times by the Solvay Process Co. at both the Syracuse and the Detroit works. The following brief statement of the conditions of operation, with the corresponding type of pump employed, compiled from information received from the De Laval Steam Turbine Co., of Trenton, N. J., is accordingly presented.

The latest addition to the Solvay equipments includes three 300-h.p. and one 75-h.p. set direct connected to steam turbines. The large units are designed to handle 6,950 gal. of water per minute at a total head of 150 ft., with 125 lb. steam pressure and 28 in. vacuum. Two of these are installed at Syracuse and one at Detroit. Each pump consists of a pair of the impeller units or centrifugal pumps proper, and of a double-geared turbine, each impeller being direct connected to the low-speed shaft of the helical speed-reduction gears characteristic of the De Laval steam turbine for general power application. This design of pump is that where the two impellers may be connected in parallel, for relatively low lifts, or in series, for high lifts. The 75-h.p. unit is also designed to handle water, but the steam turbine is operated non-condensing, with about 12 lb. back pressure; the steam pressure is 125 lb., as before, and the pump capacity is 775 gal. per minute at 250 ft. total head.

The recent electrically-driven pump additions include a 15-h.p. unit driven by a 400-volt 60-cycle two-phase alternating-current motor, with 300 gal. per minute capacity against 80 in. mercury; a 15-h.p. unit direct-connected to a 240-volt direct-current motor, with a capacity of 300 gal. per minute against 80 in. mercury; and a 5-h.p. alternating-current unit for 100 gal. against 70 ft. total head. They all handle an ammonia liquor having a specific gravity of 1.2.

For several years the Solvay Process Co. has had in service at the Syracuse plant two high-pressure pumps for boiler feed purposes. These are of the type in which there is a high-speed impeller direct-connected to the turbine shaft and a low-speed impeller direct-connected to the geared shaft, the low-speed impeller passing the water under pressure to the high-speed impeller and the latter to the boiler. They operate at 125 lb. pressure, non-condensing with 10 lb. back pressure and the capacity is 132 gal. per minute against 150 lb. boiler pressure.

The single type of pump is also in use by the company at Syracuse, where there are two 55-h.p. units employed for handling a lime water. The pump is direct attached to the geared shaft of the steam turbine. The operating conditions are: 125 lb. steam pressure; non-condensing at 10 lb. pressure; 1,200 gal. per minute; 120 ft. head. The De Laval steam turbine is also in use at Detroit in connection with the generation of electrical energy, where there are two 300-h.p. steam-turbine dynamos operating under 120 lb. steam pressure and 28 in. vacuum.

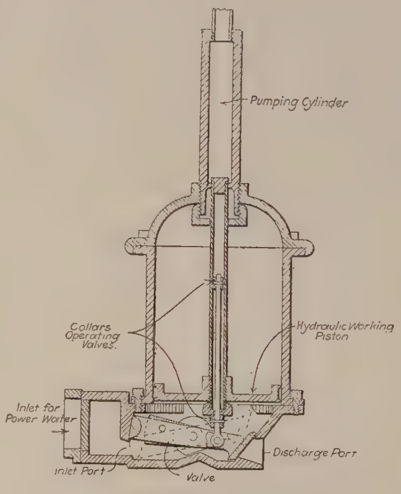
A NEW FORM OF HYDRAULIC PUMP

A new form of fluid motive-power pump that is designed to perform all the offices of the hydraulic ram with the additional property that the water or other fluid pumped can be kept separate from the water furnishing the pumping power was patented May 31, 1904, by Mr. Henry T. Farnsworth, of Glade Spring, Va. It is understood that several pumps built under this patent by Messrs. Farnsworth & Wertz, of Glade Spring, are in operation under different conditions, and the accompanying illustrations have been prepared of the cross-section of the pump and of the arrangement of the valve mechanism.

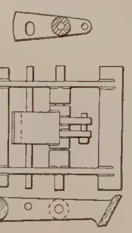
The stream of water to be employed for pumping, or the water under pressure available for the same purpose, enters the pump at the bottom through the inlet port shown. This opening gives entrance into the valve chamber, the upper cover of which, so to speak, is a piston which is raised by the energy of the inflowing water. The piston rod of this piston carries at its upper end a second piston or plunger which is the pumping plunger proper. The piston by it movement operates the valve mechanism, closing the inlet port and opening the exhaust port, from the valve chamber, at the upper limit of the stroke and reversing the operation at the lower limit of the stroke. By a suitable arrangement of pipes and check valves, the water to be pumped can be conducted into the pumping chamber during the down-stroke of the plunger and discharged during the up-stroke. The water supply used for pumping can, also, be led partly to the pumping chamber, so that the pump can be employed to deliver part of its supply to a relatively high elevation, but the separation of the propelling and pumping ends is regarded largely of value in that a water power not otherwise desirable can be harnessed to pump a separate supply, say, from a spring. In addition to these features, the scheme to minimize waste of water is indicated in the operation of the valves.

The cross-section shows the inlet port open and the exhaust closed. The two valves are rotated about the same center, so that when the inlet valve is open the outlet is closed, the two valves being fixed to the same rocking lever. The piston rod is hollow, and within it is a rod attached to the valve lever and having a collar at both bottom and top. As can be followed from the engraving, the piston on reaching the end of its up-stroke engages the collar on the rod and lifts the exhaust valve, at the same time closing the inlet valve, as the area of the piston is materially greater than that of the exhaust valve. The exhaust passage then being open, the piston descends, while the fresh supply of water to be pumped flows into the pumping chamber above, until, at the bottom of the stroke, the piston engages the lower collar on the rod, which in turn closes the exhaust port and opens the supply port.

The surface of the inlet valve is cylindrical, concentric with the axis of rotation of the valve, so that the thrust line of the water pressure is directed to the center of rotation and the free movement of the valve is thereby impeded to a minimum extent. The valve seat of the exhaust port is placed in an inclined position so that the water may act as advantage in keeping the valve closed. The port passage itself has divergent sides to secure rapid evacuation of the valve chamber.



Cross-Section through Pump



Details of Valve

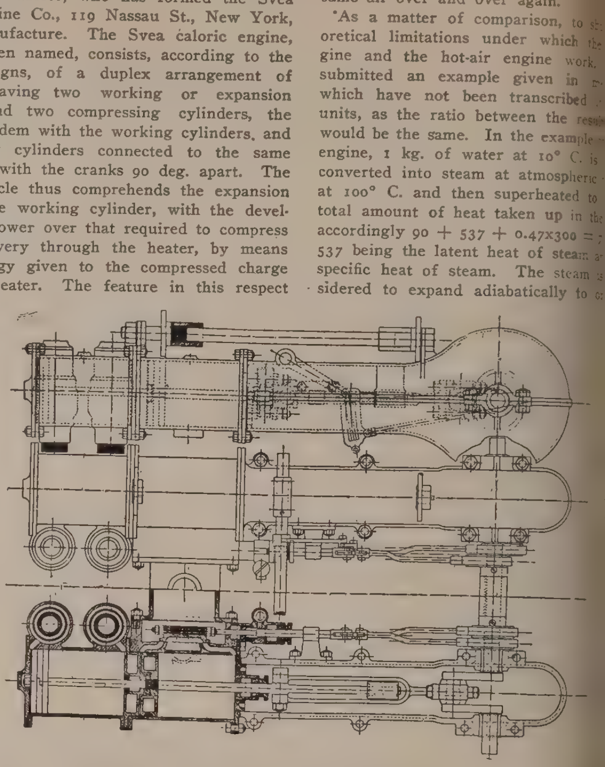
A NEW HYDRAULIC PUMP.

The pumps are made in sizes of 50 lb. pressure per square inch on the plunger to 2,000 lb. Their capacity depends, of course, on the conditions of the water supply, and on the lift against which it is to pump. They are constructed to work at 30 to 40 strokes per minute, or from 75 to 100 strokes per minute, as required. They are designed for general pumping where a light, strong and relatively compact device is desired, a pump capable of lifting water to an elevation of 500 ft. weighing, according to Messrs. Farnsworth & Wertz, 130 lb.

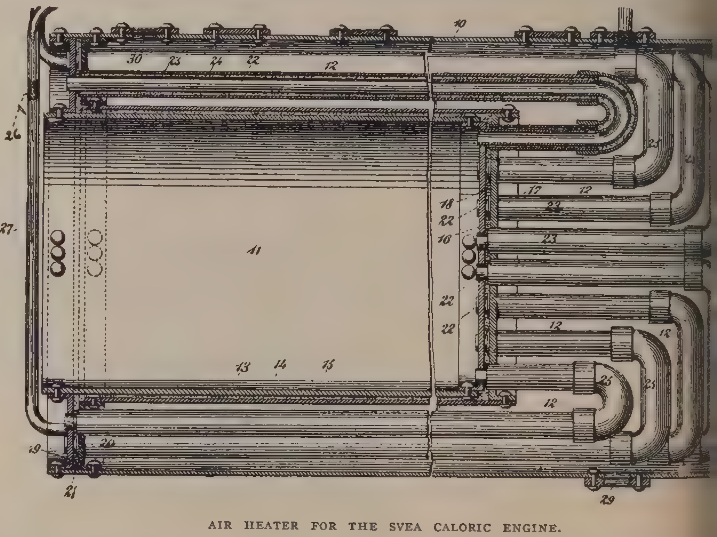
The Sprague Electric Co., 527 West 34th St., New York, has issued a new catalogue of its well-known desk, ceiling and window fans, which have been one of its specialties for many years.

THE SVEA HOT-AIR ENGINE.

A new form of hot-air engine which takes a fresh supply of air for each working stroke, compresses this charge, passes it through a heater and then expands the heated compressed charge in the working cylinder, has been developed by Mr. G. Emil Hesse, who has formed the Svea Caloric Engine Co., 119 Nassau St., New York, for its manufacture. The Svea caloric engine, as it has been named, consists, according to the present designs, of a duplex arrangement of cylinders, having two working or expansion cylinders and two compressing cylinders, the latter in tandem with the working cylinders, and the working cylinders connected to the same crank shaft with the cranks 90 deg. apart. The operating cycle thus comprehends the expansion of air in the working cylinder, with the development of power over that required to compress air for delivery through the heater, by means of the energy given to the compressed charge in the air heater. The feature in this respect appears to lie in the construction of the heater.



GENERAL ARRANGEMENT OF THE SVEA CALORIC ENGINE.



AIR HEATER FOR THE SVEA CALORIC ENGINE.

The general design of the engine and of the heater is indicated in the accompanying illustrations. Both working and compressing cylinders of the engine are double-acting. The inlets to the compressing cylinders are controlled by poppet valves, as shown, but the outlets leading to the air heater are not shown. The hot compressed air is returned to the engine at the central point between working cylinders, and the supply to the latter is admitted under the control of slide valves.

The heater is designed to make the air pass through it in well-divided sheets or currents, so that all parts may effectively absorb heat from the heated surfaces. It consists essentially of an internal furnace, from which the products of combustion are discharged through numerous tubes, and of an enclosure within which the tubes are distributed and through which, over the tubes, the compressed air is forced. In order to increase the rapid absorption of heat by the air it is understood that the heater includes a spraying device by which a certain amount of moisture may be added to the air.

The company is now building a 6-h.p. engine, of which the cylinders are 4¼ in. in diameter and 4⅞ in. in stroke, and the operating speed 450 r.p.m. The heater is 20 in. in 16 in. long, and has a heating surf ft. The engine is self starting, dou reversible. The company states tha under way a 100-h.p. stationary en is designed for a pressure of 100 l same air over and over again.

As a matter of comparison, to sh oretical limitations under which the gine and the hot-air engine work, submitted an example given in which have not been transcribed units, as the ratio between the resu would be the same. In the example engine, 1 kg. of water at 10° C. is converted into steam at atmospheric at 100° C. and then superheated to total amount of heat taken up in the accordingly 90 + 537 + 0.47x300 = 537 being the latent heat of steam a specific heat of steam. The steam is sidered to expand adiabatically to an atmosphere, when it can be shown tution in the formula for the work p adiabatic expansion that 75.8 calorie oretically obtained in the form of steam is also allowed to heat feed 10° to 90°, thereby securing 80 mor or a total of 156 heat units at the of 768 units, or a loss of 612 units this is compared the amount of heat heat the same weight of air through temperature range, from 10° to 400°. cific heat of air being 0.24, the total heat figures out 93.6 units.

The storage air-brake system of the Transit Co. is the largest installati method of car control in operation. ment was applied to 1,500 four-mot truck street railway passenger cars, formed successfully under the seve conditions attendant on the lines of pany during the Louisiana Purchase A complete description of the system tests which were made prior to its are given in a pamphlet issued by soll-Sergeant Drill Co. and The We Traction Brake Co., 26 Cortlandt St.,

EE NG OF BOSTON SOCIETY OF VIL ENGINEERS.

ting of the Boston Society of
s held on March 15, with about
ent. Two new members were
al reports of the officers and
that the society now has 563
norary members and 12 asso-
net increase of 49 members
The Sanitary Section of the
mbership of 149, of whom 15
tion only. The total income
is greater than that of last
199, but the expenses of the
reased correspondingly. The
the permanent fund is now
ve excursions to points of en-
had been made, having an
e of 30. The reports brought
t the present quarters of the
ont Temple, are entirely inade-
tional space will have to be
building now occupied or new
ters secured elsewhere. The
uarters made an exhaustive re-
the question of additional ac-
the building now occupied, of
y house of its own and of leas-
some office building. The com-
ds the acceptance of a proposi-
olk Real Estate Trust, which is
dern fire-proof building, to be
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ane and Central Sts. Here the
have more than twice the floor
pied at a sum slightly greater
of the present rooms. In addi-
y would have the use of a hall
t which will have a seating ca-
350 to 500. There will be a
the building and arrangements
whereby dinners can be served
en deired. The question of ad-
quarters will come up for con-
later meeting.

of the tellers gave the result of
officers for the ensuing year as
dent, John W. Ellis; vice-presi-
C. Coffin; secretary, S. Everett
asurer, E. W. Howe; librarian,
en; director, Edward F. Miller.
of quarters is an important one
al societies, an abstract of part of
he Committee on Quarters is given

sed by the Society is 42x17 ft., and
ed by a sub-tenant is 12½x17 ft.,
sq. ft. available for the Society.
, in which the regular meetings
are held, is on another floor in
ding, and is 60x41½ ft. wide, and
50 persons. This hall is reserved
gular meetings of the Society, but
than the regular meetings spe-
ents must be made, and the So-
n obliged on several occasions to
halls.

pace for the Society's use consists
n. ft., all of which is covered with
and closets. In addition there are
ft. in length and a case for periodi-
entral portion of the room. The
ready completely filled with books,
there is a double row, so that
books are practically inaccessible.
of the library has been such that
year new shelves have been pro-
limit has now been reached and
pportunity for increasing the shelf

ittee is impressed with the fact
the present needs of the Society
ial addition to the quarters is es-
it is furthermore convinced that
nts of the Society will be much
future than they are at the pres-
e most natural place to look for
commodations is in the building
and the possibilities in this direc-
n investigated. Probably the best
reasing the present quarters would
an additional room at perhaps
with the addition without addi-
of the corridor in front of the
s, by partitioning it off at the
are, however, serious objections
the quarters in this way. The
boring halls for choir rehearsals
purposes at times of our meetings
objectionable. The hours of clos-
ing and putting out the lights, the
smoking in the hall, the closing
g on Sundays, the elevator service,
tails of management are very un-
nd annoying.

sible with any reasonable expendi-
Society to secure a building of
its own in the business section of the city, and the nearest possible location for such a building is on Beacon Hill in the vicinity of Joy and Mount Vernon Sts. In this vicinity an old dwelling house could be obtained and fitted up to answer the present requirements of the Society for about $60,000. The chief objection to quarters in such a house is that it would necessarily be located outside the business district and many of the Committee believe that the usefulness of the Society would be very much decreased if the rooms should be located where they would not be reasonably accessible from the business districts.

The proposition is made by agents of the Suffolk Real Estate Trust to erect on Broad St. a modern fireproof building to be called the Engineering Building. In this building, on any floor which may be selected above the second, they will furnish the Society with 2,053 sq. ft. of space, extending across the entire front of the building, for an annual rental of $1,800, the space to be divided to suit the needs of the Society. The rental will also include the use at least four times each month of a hall which will have a seating capacity of from 300 to 500 persons, the hall to be located in the basement. It is also proposed to have a restaurant in the building and to have arrangements by which dinners or lunches can be served in the hall when desired. Negotiations are being made with other technical societies with a view to providing quarters for them on the same floor, but entirely independent of the quarters reserved for this Society. The right to sub-let space to the present tenants is to be granted.

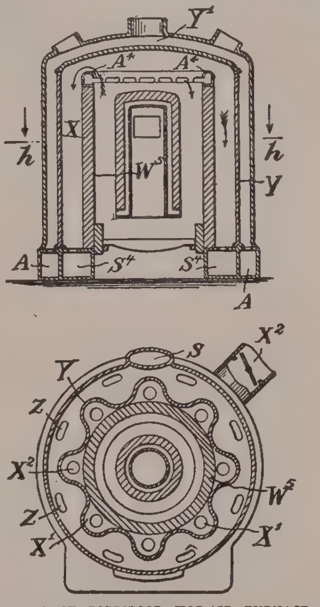

DIAGRAM OF TORRIDOOR HOT-AIR FURNACE.

The remainder of the building is to be devoted to offices, the upper portion of the building to be reserved for engineers and the lower floors for those dealing in supplies used chiefly by engineers.

For the day-time use of the members of the Society the location is a very desirable one. For the out-of-town members who visit the city, the location would be convenient, as it would be in the section of the city where the business of the out-of-town engineer would naturally call him. Furthermore, preliminary canvass of engineers indicates that a large number would occupy offices in the proposed building, and for them the advantages would be incalculable. For evening use the location is less desirable, as it is in a district which is very little frequented at night. The evening use of the rooms is very small in comparison with the day-time use, and the latter is increasing rapidly. The evening use of the rooms is at present confined to one regular meeting each month, with about 75 members attending, with possibly one or two special meetings attended by 10 to 20 persons. On the other hand, during one month the rooms are visited by several hundreds, and with more attractive quarters the number will be greatly increased.

The Dewhurst type of slag ladles and cars which has been extensively used in Great Britain is now made in the United States by the Wellman-Seaver-Morgan Co., Cleveland. The ladle is hung for dumping to either side or the rear, and is tipped by pulling a chain, which is done by the locomotive hauling the car. Several cars can be tipped simultaneously if desired.

THE TORRIDOOR HOT-AIR FURNACE.

The accompanying drawings are presented to show one of a line of inventions of Dr. J. M. W. Kitchen, of East Orange, N. J., for improving the conditions of combustion in boilers and furnaces. The series has been given the name Torridoor and it is understood that one or more of the applications are manufactured by the Willowmead Co., of East Orange. The present illustrations are sections through a hot-air furnace with self-feeding fuel magazine. The passages X carry the products of combustion and the annular conduit A-4 conducts air for combustion. The apparatus by which the extra supply of the air may be controlled is not shown.

Some of the special features which the various patented devices are intended to comprise may be briefly stated as follows: A combustion chamber having a sufficiently long run to secure the complete combustion of the volatilized gases generated before they make a first contact with any heat absorbing surface. Means for introducing air for combustion at any desirable level of the combustion chamber and under the grate line in divided currents in the form of forced jets and films.

The design of the furnace also indicates an application of the inventor's specifications that means are taken for shielding the heat absorbing surfaces of the apparatus from the heat generated in the apparatus until the first application of the heat shall have been made diffusedly over a somewhat extended surface at the highest level of the absorbing surfaces.

IMPROVEMENTS ON THE UNION PACIFIC R. R.

The following report of improvements on the Union Pacific R. R. was submitted for comment to a prominent officer of that company, who states: "We are building 67 miles of second track between Kansas City and Topeka, which will very much relieve the congested condition due to the operation of trains of both the Rock Island and Union Pacific between those points. We are also building 37 miles of single track road between Menoken and Onaga. I cannot advise you any further about the matter." The report is published as interesting, but not authenticated by this journal further than explained above:

"When the Union Pacific R. R. completes improvements now under way on the Kansas division, it will have practically rebuilt its great system which extends from the Missouri River to the Pacific coast. These improvements include the double tracking of the line between Kansas City and Topeka and the building of a new cut-off between Menoken, a few miles west of Topeka, to Marysville, a point on the St. Joseph & Grand Island system.

"There is a significance in the building of this cut-off beyond the construction of 72 miles of first-class single track. By building this connecting link between Menoken and Marysville the Union Pacific gains a short outlet, built on an easy grade, for its Nebraska and Wyoming lines to the Kansas City gateway. Now the vast bulk of freight that comes from the main line of the Union Pacific from Wyoming and the grain producing territory of Nebraska, and the large shipments from the Orient, to reach Kansas City must be detoured over heavy grades from Cheyenne to Denver or travel the main line east nearly to Omaha, then west and south to Manhattan, and thence to Kansas City over the Kansas division.

"Besides the easy grades of the line now building, the actual saving in mileage of the trains now detoured by way of Manhattan is close to 50 miles. Perhaps the most important feature, however, is the fact that the direct line from Kansas City to Cheyenne is shortened 94 miles by the building of the new cut-off. The new cut-off connects with the Grand Island tracks at Marysville. The Grand Island is now a Union Pacific property. It will not be long before there will be faster passenger schedules between Kansas City and the Pacific coast on the Union Pacific than is now possible.

"Perhaps the most congested piece of track in the West is the 67 miles of single track between Kansas City and Topeka. There is traffic enough and to spare to tax the carrying capacity of the tracks in handling the business of the Union Pacific alone, but when it is considered that the Rock Island has a joint use of the tracks with the Union Pacific it is not to be wondered that it is the busiest stretch of track in the West. Work was recently begun which will transform the single track to a splendid double-track system.

"The present line will be shifted in several places where there has been danger in the past from floods, and the second track will parallel the first track. The changes in the present track will be but slight and will involve but 14 of the 67 miles between Kansas City and Topeka. These changes will be made at Bonner Springs, Fall Leaf and Fruitland, the last named place being just west of Lawrence, where a bend in the river has given the owners of the Union Pacific anxiety for the safety of their tracks. The contract provides for first-class double track steel bridges with stone arches and abutments to replace the single track bridges and culverts now in use. Station block signal systems will be erected. The two tracks will be ballasted with rock taken from quarries owned by the Union Pacific at Loring. The depots and water stations are to be remodeled and rearranged to meet the new conditions. All sharp curves are to be eliminated and all low fills will be raised above the high water mark of 1904."

WATERPROOF CEMENT.

The announcement is made that the "Star Stettin" Portland Cement Works, long known as making one of the best German cements offered on the American market, has begun the manufacture of a waterproof cement which will shortly be offered for sale in America by Mr. E. Thiele, 99 John St., New York. The process was invented in Germany, and the claim is made for the product that even when mortar is made in the proportions of 1 cement to 6 sand, the work will become impervious to water and will resist frost, heat, hot water, sea water and diluted acids. It is also said that the surfaces of such work will not be disfigured by crazing, hair cracks or efflorescence.

These qualities seem to be secured without departing from the requirements made of a high-grade Portland cement as regards fineness, strength, durability, constancy of volume, uniformity in color, etc. These are large claims and indicate that some of the difficulties met with by cement users are in fair way of removal. The action of the cement in practical work under American conditions will be watched with great interest by every cement user.

TRADE PUBLICATIONS.

Some useful tables of the thickness of plates required for riveted hydraulic pipes of different diameters and for different pressures, and of the frictional resistance and discharge of such pipes, are given in Bulletin 5 of the Abner Doble Co., San Francisco. This pamphlet also gives some useful data regarding the effective horse-power and discharge of jets.

The general catalogue of the Filer & Stowell Co., Milwaukee, is unusually full of information of interest to prospective power-plant purchasers. Very full tables and descriptions are given of the Corliss and rocking-valve engines, compressors, pumping machinery and condensers made by the company, and in addition there are many discussions of points to be considered in selecting engines for different classes of service. Unusually clear suggestions for laying out the foundations for an engine plant are also given in this book.

An automatic feed pump and receiver is described in Bulletin B 81 issued by the Geo. F. Blake Manufacturing Co., 114 Liberty St., New York. This apparatus is arranged to automatically pump water of condensation directly back to the boilers and is used for draining steam coils, radiators, heaters, drying cylinders, steam jackets, etc.

Although the Portland cement industry has grown with surprising rapidity in this country of late, the development of the cement machinery business of the Allis-Chalmers Co. has more than kept pace with it. This is shown by the fact that in 1903, when a little more than 20,000,000 bbl. of American Portland cement were made, this company sold cement machinery of an aggregate capacity of 5,000,000 bbl. of finished cement per annum. The company's catalogue 119 is a well-illustrated book of 44 pages devoted exclusively to descriptions of rock crushers, conveyors, crushing rolls, rotary dryers, ball mills, tube mills, mixing pans, pneumatic pumping apparatus for handling slurry, rotary kilns, raw material bins, clinker coolers, coal crushers and other equipment. More information of a definite character concerning the machinery in the cement industry can be obtained from this book than from most volumes on engineering materials.

A pamphlet giving illustrations of interesting features of a number of installations of underground electric cables of various types has been issued by Johnson & Phillips, Charlton, Kent, England. The company not only makes rubber, paper and dry-core cables, junction boxes and other accessories, but contracts for their installation.

The Ellis-Ford Pipe Cutter Co., Great Falls, Mont., has issued a pamphlet describing a machine for cutting any kind of metal pipe. It takes up very little room in a trench and severs the pipe by means of cutter wheels carried in a link belt which presses strongly against the surface on the line of the cut.

A valuable reference book of data concerning brass, copper, german silver and brazed, seamless and iron-lined tubing is given in a book prepared by the Waterbury Brass Co., Waterbury, Conn. There is so much information of such a varied nature in it that space prevents a complete summary of its contents, which will prove of use to everyone using brass, copper, bronze and other metals of this class.

A reversible fan and one-piece fan wheel are described in Bulletin 58 of the New York Blower Co., 25th Place and Stewart Ave., Chicago. The wheel is made in one piece by having the cone cast around the ends of the sheet steel vanes. The pulley can be placed on either the right or left hand of the fan and the discharge opening can be pointed in any direction. This fan has been designed particularly for handling shavings, wool, cotton dust and similar materials.

The Interpole variable speed motor is described in detail in Bulletin 5B of the Electro-Dynamic Co., Bayonne, N. J. The construction of the various parts is explained and various curves are given to show the operating conditions. The motor gives constant power at all speeds, or the speed curve can be made to assume any desired form; the form is controlled by the graduation of resistance in the field rheostat.

The Builders Iron Foundry, Providence, R. I., has issued a small calendar on thin celluloid which can be carried very handily in a pocket-book.

A great variety of dump carts for contractors' uses are described in a catalogue from Hobson & Co., 17 State St., New York. Most of these have two wheels, although some have four, and the differences in their design are mainly in the shape of the body and width of tire. A light sprinkling cart is also described.

Drill grinders were first put on the market by the Washburn Shops, Worcester, Mass., in 1887. Since then they have been improved and their number increased by many varieties, large and small, for dry and wet grinding, and for right-handed or left-handed drills. A catalogue of them, which also gives suggestions for grinding drills, has just been issued by the shops.

A 252-page catalogue of blacksmith's tools, issued by Patterson, Gottfried & Hunter, Ltd., 146 Center St., New York, is a very complete list of forges, blowers, anvils, vises, tools, tire benders, bolt and nut machines, drills, taps and dies, grindstones, punches, shears and other equipment for such work.

The third number of the beautiful "American Art in Bronze and Iron" series, published by the John Williams Bronze Foundry, 556 West 27th St., New York, is devoted to American sculpture in bronze. The text has been written and compiled by Mr. Wm. Donald Mitchell, and is an interesting commentary on the many statues of which illustrations are given. The book is handsomely printed and is a valuable record of a department of American art which is very creditable to those engaged in it.

The Westcott Chuck Co., Oneida, N. Y., has issued a catalogue describing the construction of the large variety of lathe and drill chucks which it makes. The method of using them is explained and the advantages of the different styles for various purposes are stated.

The Carson Trench Machine Co., Boston, Mass., has prepared three catalogues of its apparatus which will prove useful reference books to all who have trench excavation to do. The first describes the Carson machine, by which any number of tubs are simultaneously hoisted from a trench or pit, moved horizontally as far as desirable, and there dumped. The second describes the Carson-Trainor hoister and conveyor, a lighter machine with a single bucket operated like a cableway skip, and particularly useful in clay and gravel trenches of considerable width. The third catalogue describes the Carson-Lidgerwood cableway, which is particularly adapted for trenches in rock and quicksand.

The catalogue of the Direct Separator Co., Syracuse, N. Y., describes the separators for removing water from live steam, oil from exhaust steam and moisture from ammonia gas, the exhaust heads and the Powers' steam traps manufactured by the company. Reports of tests of the Sweet's steam separators and of the Sweet's oil separators and lists of their users are given in another publication issued by the company.

The pulverizers, disintegrators, shredders, roll crushers and rotary crushers manufactured by the Jeffrey Mfg. Co., Columbus, Ohio, are described in its catalogue No. 30. This company has recently purchased from the Schoellhorn-Albrecht Machine Co., the patents covering its crushing machinery and will manufacture that machinery in the future.

Bulletin A, issued by The Jeffrey Mfg. Co., Columbus, Ohio, gives an illustrated description of the combination coal handling and distribution and ash handling plant of the power station of the Scioto Valley Traction Co., at Reeves Station, Ohio.

The design of Luten reinforced concrete arches is explained in a pamphlet issued by the National Bridge Co., Indianapolis, Ind. Descriptions and illustrations of bridges ranging from 20 to 95 ft. in span, built according to this system, are given in the publication.

A discussion of the problem of ties for steam and street railway tracks is given in a pamphlet issued by the American Railway Tie & Girder Co., Pittsburg, Pa., and an illustrated description of the steel tie and girder construction manufactured by the company, with views of tracks where wooden ties have been replaced by this construction, is also included in the pamphlet.

BUSINESS NOTES.

The Sullivan Machinery Co., of Chicago, has opened a branch office in Salt Lake City, in the Keith Bldg. Mr. John C. Taylor, formerly of the Denver office, will be its manager. A full line of Sullivan straight-line air compressors and rock drills with mountings, equipment and duplicate parts, will be carried in stock; and inquiries for diamond core drills, heavy hoisting engines, coal-cutting machines and quarrying machinery for this district should be sent there.

The Simplex Concrete Piling Co., Washington, D. C., has recently closed contracts for 40,000 lin. ft. of 16-in. piling for foundations for the power house, smoke-stack and inspector's building at the new Union Station, Washington, and the foundation of a stack at the Westinghouse Machine Co. Works, East Pittsburg, Pa. The company recently drove thirty-one 35-ft. piles, 16 in. in diameter, with a single machine in one day. It has designed a new driving point which, instead of being detachable and remaining permanently in the ground, is attached to the driving shell and is removed with it.

Post & McCord, New York, have recently taken orders for steelwork in a 1200-ton, 65x105-ft., 11-story, steel-cage building, at Fifth Ave. and 44th St., New York, and the Morton Memorial laboratory at Stevens Institute, Hoboken. The shops have started the steel for a 9-story addition to the 24th St. building of the Y. M. C. A., and erection has begun on a 99x112-ft., 8-story building for the McCall Pub. Co., on West 37th St., and on a 100x100 11-story loft building on East Houston St. for Fisher Bros. The foundation grillages have just been shipped for the 1200-ton building for the Waterside power station of the New York Edison Co., at East 39th St. The firm states that there is apparently plenty of capital ready for investment in commercial buildings; the amount of such work on hand now is greater than last year at this time, with the prospects good for steady prosperity in the near future.

The Blaisdell Co., Los Angeles, Cal., will furnish the Black Mt. Mining Co., Magdalena, Sonora, Mex., a complete equipment of sand-vat distributors, excavators and tailings stacking machinery, with a capacity of 100 tons of sand per hr.

The control of the Lazier Gas Engine Co. has been secured by Arthur A. Lazier, who has organized the Lazier Engine Co. to conduct the business. The offices will be in the Ellicott Square Bldg., Buffalo. Arrangements have been completed with the DuBois Iron Works for the manufacture of the engines at that plant. Eighteen sizes, from 2 to 100 hp., will be made.

The Roebling Construction Co., 23d St. and Broadway, New York, reports taking the following contracts for fireproof floor, roof and partition work: New York, two residences on Fifth Ave., Carnegie Library No. 3, Yorkville Bank, Sevilla Home for Children, Williamsburg Power House of Brooklyn Heights Ry. Boston, State St. Trust Co. building. Baltimore, 8-story Law building and Consolidated Gas Co.'s building. Chicago, Brooks Casino. Pittsburg, factory for Harbison-Walker Refractories Co. Providence, Young Women's Christian Association building. South Dakota, court house at Pierre and post-office at Deadwood. San Francisco, building for Pacific Telephone & Telegraph Co. Montgomery, Ala., Montgomery Hotel. St. Louis, Bell Telephone Co.'s Lindell Exchange building. Poughkeepsie, First Presbyterian Church building. Philadelphia, Conkling-Armstrong Architectural Terracotta Co.'s kiln building.

The steam specialty business conducted in Boston, under the firm name of Wm. T. Bonner & Co., has been incorporated and will hereafter be conducted at 244-248 Summer St. by the Wm. T. Bonner Co. The business will cover a much larger line of steam-plant accessories than heretofore, and particular attention will be paid to specialties for high pressure and superheated steam. The officers are Wm. T. Bonner, president and engineer; Lewis H. Homer, treasurer and secretary; P. A. Jerguson, superintendent; John R. Marvin, assistant engineer. The New York office will be continued at 141 Broadway, and agencies will be established in other large cities.

The range of products made by the Westinghouse Electric & Mfg. Co. is well shown by some recent orders. As an extension to its system the Louisville Ry. Co. will install two 750-kw., three-phase rotary converters, six 300-kw. air-blast transformers and two switchboards. The United Railways & Electric Co., Baltimore, has contracted for three 1,000-kw. rotaries and nine 350-kw. air-blast transformers. These will operate on a 13,000-volt line, transforming to 330 volts. Eighteen rotary converters, with a total capacity of 27,000 kw. will be placed in substations of the New York Central Ry. Two 1,500-kw., direct-current generators will be built for the Carnegie Steel Co., to furnish power for two 1,500-h.p., 250-volt motors, said to be the largest ever built for this voltage. Among orders for small apparatus may be mentioned one from the Surpass Leather Co., of Philadelphia, for 18 induction motors, from ½ to 30 h.p. The State Co., of Columbia, S. C., has contracted for 12 direct-current motors, from 1 to 20 h.p., and Murdock, Kerr & Co., of Pittsburg, will receive the same number having outputs of 2 to 70 h.p.

The Harrington-Wiard Co., mechanical engineers and builders of gasoline motors and experimental machinery specialties, plan to move from Buffalo to Batavia, N. Y., during April. The gasoline engines now manufactured in sizes of 3½ and 6 h.p., for example, for marine and automobile use, are to be extended in power range to 50 h.p. The present machines operate on the four-stroke cycle, with one and two cylinders.

The Wyckoff Pipe & Creosoting Co., Stamford, Conn., has received a contract from the Isthmian Canal Commission for creosoted piles A very large order for creosoted Wyckoff conduits has also been received from the New England Telephone & Telegraph Co., and several for creosoted bridge flooring plank from the American Bridge Co.

The power plant in the Wells Bldg., Milwaukee, will shortly receive a vertical cross-compound Reynolds-Corliss engine, direct-connected to a 500-kw. Bullock d. c. generator. It will have 24 and 40 in. cylinders, 36-in. stroke and is rated at 700 hp. at 100 r. p. m. and 145 lb. steam pressure.

E. B. Boye has been appointed manager of the Cleveland office of Manning, Maxwell & Moore, which is located in the Williamson Block. Mr. Boye has for the past five years been connected with the firm's Chicago branch.

PERSONAL NOTES.

Mr. L. W. Rundlett has been reappointed Commissioner of St. Paul for three years.

Mr. C. L. Crugar has been appointed resident engineer of the Louisville & Nashville R. R., at La Follette, Tenn.

Mr. H. Rettinghouse has been appointed division engineer of the Wisconsin Central R. R., at Fond du Lac, Wis.

Mr. B. B. Stakemiller has been appointed engineer of maintenace of way of the Illinois Terminal R. R., at Alton, Ill.

Mr. W. U. Polk has been appointed assistant engineer of the Maryland, Delaware & Virginia R. R., at Love Point, Md.

Mr. Arthur Grover has been appointed city engineer, superintendent of streets and superintendent of water works of Rutland, Vt.

Mr. John F. Wallace, chief engineer of the Isthmian Canal Commission, has been also appointed general superintendent of the Panama R. R.

Mr. R. P. Johnston has been appointed resident engineer on the electrical work at the terminus of the New York Central & Hudson River R. R.

Civil Engineer J. V. Rockwell, U. S. N., has been transferred from duty at the U. S. Naval Academy to the naval sta
Juan, P. R.

Mr. Elmer W. Stearns, formerly
the Berlin plant of the American
has accepted a position with the
Bridge Co., Masaquan, N. J.

Mr. John V. Coyer, a promin
and surveyor of Indianapolis, died
on March 15. His son-in-law, Mr
Klausman, is the present surveyor
County, Ind.

Mr. F. W. Bailey, resident engi
Missouri, Kansas & Texas Ry., at
been promoted to the position of su
of bridges and buildings, with hea
Denison, Tex.

Mr. A. Z. Drozdov, formerly
gineer of the Virginia Bridge & Ir
noke, Va., has been appointed chief
the company, to succeed Mr. H. W
has resigned.

Mr. F. Lavis, author of the paper
location in the Southwest, which
in this journal on Jan. 7, has bee
resident engineer of the New York,
& Boston Ry., at Mt. Vernon, N.

Mr. O. F. Nichols, chief engin
Department of Bridges, New Yor
livered a lecture, illustrated by lar
graphs, on the Manhattan Bridge
proaches, before the Brooklyn Instit
and Sciences, March 24.

Mr. John Reis, assistant to Pres. C
U. S. Steel Corporation, has been
charge of its new department, kno
bureau of construction. All matte
to construction of mills will be ref
hereafter.

Mr. Walter Mulford, a graduate of
of Forestry of Cornell University, h
pointed assistant professor of fores
University of Michigan, but it is
that his duties at Ann Arbor will
before the opening of the next coll

Mr. Niven McConnell, designer a
tendent of the Donora works of th
Steel Co., has resigned to become vi
and general manager of the Passaic
His successor will be Mr. H. J. D
tant superintendent of the Homest

Prof. George E. Waesche, of the
of Civil Engineering of Purdue Univ
been granted leave of absence to
water-power developments in centra
His classes will be conducted by
Smith, of the structural department
nois Steel Co.

Vacancies in the grade of hydrog
U. S. Geological Survey, will be filled
nations on April 19-20 in all the larg
the country. The subjects will be m
hydrography, elementary water suppl
ing, water purification, sewage disp
istry of water and physical geography
information can be obtained from th
Examiners, U. S. Civil Service Com
any large city.

Mr. N. D. Phelps, recently appoin
manager of the Allis-Chalmers Co.,
quarters at Spokane, studied mining
at the University of California and
work as timekeeper at the Unon I
He gradually rose through positio
sales staff and was afterward transfe
construction department. He was fi
in charge of the company's mining
which he gave up to undertake his
ties.

The Civil Engineers' Club, of
elected the following officers at its a
ing: President, Bernard L. Green;
dent, Dr. D. C. Miller; secretary,
Beardsley; treasurer, Arthur G. Mc
rian, Elmer B. Wight; directors, C
Kingman and Chas. H. Wright. T
now 25 years old, and has had a d
list of presiding officers. The firs
was Charles Paine, whose term ext
March 11, 1880, to September 14,
John M. Wilson, U. S. A., was
president, from 1882 to 1883. The
dent, Josephus F. Holloway, served
to 1886. All the other presidents
one year only. They were in order
to twenty-first: Charles Latimer, J
law, Worcester R. Warner, William
Joseph Leon Gobeille, Walter P.
H. Porter Ambrose Swasey, Aug
decai, Charles S. Howe, Jame
Frank C. Osborn, Gen. Jared A. Smit
Charles W. Hopkinson, Charles H.
Samuel T. Wellman, Walter C. P
Alexander E. Brown. The Club w
rated in 1891, and in 1899 arrange
Electric Club, the Architectural Cl
Chemical Society for joint use of r

ACTING NEWS

ECIAL INTEREST TO
RS, BUILDERS, ENGINEERS
MANUFACTURERS
NG AND BUILDING SUPPLIES.

WATER.

ged alphabetically by States.

—J. B. McCrary & Co., of At-
the contractors for the proposed

z.—See "Power Plants, Gas and

—Mayor P. J. Lyons in his an-
to Council recommends the con-
early date, of another 10,000,000-

Ariz.—See "Miscellaneous."

iz.—It is stated that bids will be
Apr. 3 by the Mayor and Com-
for furnishing horizontal double-
plunger outside packed water
city of 350 gals. per minute; 200-
nd setting; a 120-h.p. horizontal
ndensing Corliss steam turbine or
ustion steam engine, etc. E. B.
Clk.

Cal.—See "Power Plants, Gas and

Colo.—Specifications are on file at
The Engineering Record, for fur-
ial and constructing a reservoir,
rage tank and distribution system
pened on Apr. 1), as advertised in
ing Record.

Conn.—The Legislature is reported
ed a resolution, authorizing Rock-
$75,000 for a filtration plant.

ll.—G. B. Sidelinger, Supt. Dan-
Co., writes that the only improve-
plated at this time is to lay about
12-in. pipe.

Ill.—See "Power Plants, Gas and

Ill.—The water works and electric-
s reported to be now under control
rporation, to be known as the Con-
ater & Light Co., with a capital of
t is proposed to erect a new power-
ld water-works station is to be torn
the flume enlarged. It is also pro-
in auxiliary steam power. John M.
Pres.; A. E. Cooper, Secy.

, *Ill.*—S. M. Henderson, Pres. Vil-
rites that the National Constr. Co.,
nd, Ind., bid, on Feb. 28, $4,547 for
compressed air water system in Wa-

Ill.—Bids are wanted Mar. 31 for
and delivering 10,613 pieces 4, 6, 8,
nd 36-in. c. i. water pipe; also Apr.
hing and installing 4 internally fired,
return tubular boilers, fitted with
all necessary appurtenances in 68th
Station; bids are also wanted Apr.
hing and installing 4 internally fired,
return tubular boilers fitted with
all necessary appurtenances in Har-
mping Station. F. W. Blocki, Comr.

a.—C. S. Adams, City Clk., writes
voted Mar. 13 to issue $14,000 bonds,
struction of water works.

lls, Ia.—Fremont Turner, of Des
stated to have secured the contract
cting a pumping plant (bids opened
r $8,000.

Kan.—L. K. Green, Chmn. Water
s that the contract for an 80,000-gal.
n a 100-ft. steel tower (bids opened
as been awarded to the Kenwood
Chicago, Ill., for $4,442.

ans, La.—Bids will be received May
ewerage and Water Bd. for connect-
water pipe recently laid by said Bd.
with Chestnut St. main of New Or-
Wks. Co. F. S. Shields, Secy.

Me.—Bids will be received by W. B.
ngr. Augusta Water Dist., on Apr.
g a c. i. pipe line, about 8½ miles in
appurtenances, from Carleton Pond,
to the distributing reservoir of the
ater Dist., in Augusta, as advertised
gineering Record.

Me.—W. P. Hubbard, Secy. Bodwell
er Co., writes that the company has
m the State Legislature an amend-
s charter allowing certain improve-
no formal action has yet been taken.

, *Md.*—It is stated that bids are
the Bd. of Awards until Mar. 29 for
and delivering complete 10—16 and
water valves. Alfred M. Quick, Wa-

Mass.—W. E. Swan, Ch. Clk. and
r Dept., writes that the contract for
2,000 tons, c, i. water pipe (bids
. 21) has been awarded to U. S.
ipe & Fdry. Co., of Philadelphia, Pa.,

, *Mass.*—The citizens are reported to
on Mar. 16 to purchase the plant of
Water Co., for $250,000.

Mich.—See "Power Plants, Gas and

Minn.—The City Council is consid-
ng the city into a number of districts,
g one district each year. All meters
ed and put in by the city. G. P.
ity Engr.

r Lake, Minn.—The citizens of this
reported to have voted Mar. 14 to
o bonds for the construction of wa-

er Falls, Minn.—Oscar Claussen, of
s reported to have estimated the cost
ting water works here, at $23,600.

lis, Minn.—Ellis R. Dutton, Asst. Engr., writes that the following are the bids opened on Mar. 10 for 1,017 tons 6, 8, 12 and 16-in. c. i. pipe: Jas. B. Clow & Sons, Chicago, Ill., $28.70 per ton, and U. S. Cast Iron Pipe & Fdy. Co., Chicago, Ill., $27.90. The N. W. Fdy. Co., of Minneapolis, bid for 22 tons special castings, 2.6 cts. per lb. delivered on work.

New Albany, Miss.—See "Power Plants, Gas and Electricity."

Ellisville, Miss.—Bids will be received until Apr. 4 by Wm. M. Hardee, City Clk., for constructing water works as advertised in The Engineering Record.

Lumberton, Miss.—Bids will be received by H. A. Camp, Mayor, on Apr. 4 for drilling or boring an 8-in. artesian well, as advertised in The Engineering Record.

Poplarville, Miss.—Bids will be received by D. F. Archer, Mayor, on Apr. 4 for drilling or boring an 8-in. artesian well, as advertised in The Engineering Record.

Humansville, Mo.—Burns & McDonnell, of Kansas City, are preparing plans and specifications for water works for Humansville. Bids for $12,000 water bonds will soon be called for.

Alma, Neb.—See "Power Plants, Gas and Electricity."

North Platte, Neb.—Bids will be received at the office of the U. S. Reclamation Service, Chamber of Commerce Bldg., Denver, Colo., on May 16 for the construction of about 45 miles of main canal, for the irrigation of lands in North Platte Valley in eastern Wyoming and western Nebraska, as advertised in The Engineering Record.

Yuma, Ariz.—The following are the bids opened on Mar. 15 by the U. S. Reclamation Service of Los Angeles, Cal., for the construction of Laguna dam and sluiceways for the diversion of a part of Colorado River, about 10 miles northeast of Yuma, Ariz. (J. B. Lippincott,, Superv. Engr., 1108 Braly Bldg., Los Angeles, Cal.). (*a*) Orman & Crook, Pueblo, Colo.; (*b*) P. McDonald, Duluth, Minn.; (*c*) City Street Impr. Co., 512 Mills Bldg., San Francisco; (*d*) Faris-Kesl Constr. Co., Boise, Idaho; (*e*) Mosier De Graff Const. Co., 1266 Seneca St., Buffalo, N. Y.; (*f*) Griffith & McDermott, 1011 Merchants Loan Bldg., Chicago, Ill.; (*g*) Bentley Tuttle & Pelton Co., 615 Haight St., San Francisco; (*h*) J. T. White & Co., 43 Exchange Pl., New York, N. Y.; (*i*) Black & Laird, Birmingham, Ala.; (*j*) Andrew Holloway, Pasadena; (*k*) (1) Chicago Eng. & Const. Co., 1301 Great Northern Bldg., Chicago; (*k*) (2) Chicago Eng. & Const. Co. (alternative bid); (*l*) N. S. Sherman, Oklahoma City, Okla. Ter.; (*m*) Keltie Constr. Co., 211-12 Babber Bldg., Joliet, Ill.; (*n*) Burrell Constr. Co., Oakland, and (*o*) Colton Bros., Oakland.

	Excavation.						
	Class 1, 305,000 cu. yds.	Class 2, 282,000 cu. yds.	Placing rock in dam, 305,000 cu. yds.	Laying pavement, 80,000 sq. yds.	Concrete, 27,150 cu. yds.	Furnish. & driv. sheet piling, 53,000 lin. ft.	Total.
a	$0.98	$0.55	$0.40	$1.35	$5.00	$0.30	$835,650
b	1.35	.35	.40	1.25	4.75	.40	822,612
c	1.30	.40	.43	1.10	5.00	.35	882,750
d	1.25	.40	.65	1.00	4.00	.55	924,150
e	.95	.50	.50	2.50	4.35	.50	927,852
f	1.39	.44	.52	1.11	4.46	.35	935,069
g	1.70	.66	.27	.62	4.00	.50	971,670
h	1.60	.30	.80	2.27	5.50	.41	1,169,255
i	2.05	.33	.70	1.75	4.75	.54	1,229,392
j	1.35	.70	.80	2.40	8.00	.60	1,294,150
k (1)	2.44	.35	.20	2.71	5.42	.52	1,295,413
k (2)	2.64	.35	.20	2.71	5.42	.52	1,356,413
l	1.60	.75	1.45	3.30	5.05	.50	1,569,357
m	2.25	1.50	1.35	3.00	4.00	1.20	1,933,200
†*n*	1.30	.70	.09	.09	3.00	.59	741,270
†*o*	1.10	.90	.06	1.00	5.15	.40	848,622

†Irregular bids.

Newark, N. J.—Engr. Edw. S. Rankin, of the Dept. of Sewers and Drainage, is stated to have submitted to the Bd. of Wks. a report on sewers proposed for the Silver Lake section of the city. The plans have been considered; 1st, to connect with the orange outlet sewer in Mill St., Belleville; 2d, to connect by a gravity line with some existing Newark sewer, and 3d, to establish a small pumping station at N. 6th St. and old Bloomfield Road, in order to lift the sewage and discharge it into the Forest Hill main on 2d St. The engineer favors the third plan, which would cost about $27,000.

Spencer, N. C.—Plans and specifications are being prepared by Henry A. Pressey, 1416 F St., Washington, D. C., for water works, sewage and street improvements for Spencer.

**Charlotte, N. C.*—The contract for the erection of the new city standpipe is stated to have been awarded to the R. D. Cole Mfg. Co., of Newnan. It will be erected at 5th and Graham Sts., be 135 ft. high, 30 ft. in diam., and have a capacity of 700,000 gal.; contract price reported to be about $16,000.

**Clear Lake, N. D.*—G. E. Force, City Aud., writes that the National Constr. Co., of South Bend., Ind., has secured the contract for constructing water works at Clear Lake.

New Market, N. J.—The Piscataway Water Co., of New Market, has been incorporated, with a capital of $10,000. David Lawson, of New Market, is the agent in charge.

Edw. S. Lukens and Wm. S. Wallace, of Philadelphia, and S. H. Hicks, of Bryn Athyn, were given two charters. One for the High Ridge Water Supply Co., to furnish water in St. Clair Township, Westmoreland County, and the other to the Mercantile Water Supply Co., to operate in Union Township, Bedford County. Both companies capitalized at $5,000.

**Callicoon Depot, N. Y.*—E. W. Moxley, of Jefferson, Consulting Engr. for Callicoon Depot Water Co., writes that O'Hehir, Brooks & Co., of Warwick, have secured the contract for constructing water works (bids opened Mar. 16).

Westfield, N. Y.—The citizens are reported to have voted Mar. 14 to extend the water works, at a cost of $2,500.

**Medina, N. Y.*—The following are the bids opened on Mar. 1 for the construction of water works (Engineer, J. F. Witmer, Chapin Blk., Buffalo). The work required consists of 1,650 tons cast-iron pipe, 125 fire hydrants, 120 gate valves, 16 miles pipe-laying, 12 to 4 in.; 2 turbine pumps and electric motors, brick pumping station and concrete reservoir: Albany Material & Construction Co., Albany, N. Y., $93,608; Chambers & Grady, Rochester, N. Y., $89,982; L. J. Richardson Co., Owego, N. Y., $80,702 (awarded contract for construction); G. H. Eldredge, Ossining, N. Y., $88,561; Swanson & Callahane, Jamestown, N. Y., $80,902; Geo. M. Bole Contracting Co., Pittsburg, Pa., $89,376; Denniston & Co., Rochester, N. Y., $81,330; Dean & Havens, Olean, N. Y., $88,761, and J. W. Danforth & Co., Buffalo, N. Y., $85,600. Chas. Millar & Son, Utica, N. Y., will furnish pipe and special castings. The Eddy Valve Co., Waterford, N. Y., will furnish hydrants and valves.

Springfield, O.—The Water Wks. Com. and the Bd. of Pub. Service are stated to have decided to recommend to Council the construction of water mains and extensions amounting to $10,427.

Collinwood, O.—The citizens are reported to have voted Mar. 14 to issue $15,000 bonds for better fire protection and for the extension of the water system.

**Lorain, O.*—Local press reports state that the following are the bids opened on Mar. 11 for constructing a settling basin at the water works pumping station, to be 150 ft. long, 50 ft. wide, and 24 ft. deep—*a*, concrete; *b*, brick: McCracken & Co., Cleveland, *a*, $17,612; *b*, $15,712. Hunkin Bros. Co., *a*, $18,245; *b*, $19,745. Jas. Duff & Co., Cleveland, *a*, $15,332; *b*, $17,552. C. H. Fath & Son, *a*, $17,986; *b*, $18,811. McManis & Russell, Cleveland, *a*, $12,885: *b*, $19,905. W. J. Townsend Co., Cleveland, *a*, $20,000; *b*, $18,890. W. J. Gawn, Cleveland, *a*, $15,550; *b*, $19,300. Faragher Eng. Co., Lorain, *a*, $16,035; *b*, $20,535. Ohio Eng. Co., Elyria, *a*, $16,280. Carey Constr. Co., *a*, $12,400 (awarded contract).

Cleveland, O.—Bids will be received Mar. 29 by the Bd. Pub. Service for furnishing and delivering all ⅝-in. water meters that may be required by Water Wks. Division of said Bd. during year 1905; estimated quantity, 10,000. A. R. Callow, Secy.

Elyria, O.—Bids will be received by the Bd. of Pub. Service on Apr. 11 for a horizontal cross-compound crank and flywheel high duty pumping engine, of 5,000,000-gal. daily capacity, as advertised in The Engineering Record.

Warren, O.—See "Power Plants, Gas and Electricity."

Shippensburg, Pa.—The Borough of Shippensburg invites inspection of a newly constructed concrete reservoir, which has failed to hold water, owing to its situation on a limestone hill, leading to competitive bids for guaranteeing making same water tight. Communications can be sent until Apr. 1 to President or Clerk of Council.

Connellsville, Pa.—T. J. Mitchell, of Connellsville, Pres. Riverside Water Co., writes that the company will receive bids on Apr. 15 for the construction of water works, to cost $30,000.

Bids will be received on Apr. 1 by Laura Callaway, Town Clk., for the purchase of $100,000 water bonds.

Ebensburg, Pa.—An application has been made for a charter for the Hemlock Water Co. to supply water in Washington Township. Incorporators: Philip N. Shettig, M. D. Kittell and Chas. Hasson, all of Ebensburg.

Tyrone, Pa.—A. A. Stevens, Geo. B. Stevens and C. H. Diffenbaugh, of Tyrone, are reported to have formed the Tyrone Water Supply Co., to operate in Snyder Township, Blair County, and at Tyrone; capital, $5,000.

**Ford City, Pa.*—A. V. Parnell is reported to have secured the contract for a pump and 2 gas engines for the water works, for about $5,900.

Harrisburg, Pa.—Among the charters issued on Mar. 17 are reported to be the following:

The Tripp Water Co., to supply water in Brady Township, Huntingdon County; capital, $5,000. Chas. E. Covert, Robt. H. Hay and Geo. M. Whitney, of Harrisburg, are the incorporators.

Columbia, S. C.—E. N. Chisolm, Jr., City Engr., has completed a report on the auxiliary steam pumping station. He recommends that an auxiliary steam plant be built at a moderate cost by erecting a corrugated iron building for a pumping station; the purchase of one 3,500,000-gal. pumping engine, and one 175-h.p. boiler, with smokestack, and erect them in this building; also the removal from the pump pit of the 1,500,000-gal. Worthington pump and locate it on the foundation in same room and adjacent to the 3,500,000-gal. pump and connect them with same suction and discharge main.

Dresden, Tenn.—There is reported to be a movement here looking to the construction of water works.

Cookeville, Tenn.—See "Power Plants, Gas and Electricity."

Granbury, Tex.—The City Council is reported to have granted the Frisco Ice & Light Co. a franchise for water works.

Luray, Va.—The plant of the Luray Electric Co. has just been completed, and the company is now in the market for fans and motors for alternating-current, 110-volt, 60-cycle single phase.

**Manchester, Va.*—J. L. Lindsay, of Richmond, is reported to have secured the contract for a boiler and 2 pumps, for about $3,700.

Rockford, Wash.—J. B. Gilbert, City Clk., writes that it was voted Mar. 7 to issue bonds for water-works improvements.

Tacoma, Wash.—The City Council has under consideration an offer from the Equitable Finance Co., of Portland, Ore., to construct a hydraulic power plant on Nisqually River, 25 miles from Tacoma, to furnish 5,000-h.p., the city to take the plant when completed. Frank L. Davis, City Engr.

Spooner, Wis.—Bids are wanted Mar. 30 for constructing water works, consisting approximately of concrete dam, turbine and shafting, pump, 4,000 ft. 8-in. pipe and 7 hydrants. Oscar Claussen, Engr. Natl. German-American Bank Bldg., St. Paul, Minn.

Monterey, Mex.—Messrs. Farias and Garcia, of Monterey, are reported to have obtained a concession to establish a system of irrigation just west of this city. They propose to build a solid masonry dam to form a water storage reservoir with a capacity for 250,000,000 gal. From this reservoir the water will be distributed over land by pipe lines and irrigation ditches. Monterey engineers are reported to be in charge of the construction work.

Las Cruces, N. M.—The farmers of the Mesilla valley are stated to have filed incorporation papers for the Elephant Butte Water Users' Assoc., with a capital of $4,400,000. Headquarters are at Las Cruces. Herbert B. Holt, Pres.; Henry D. Bowman, Treas. This is the first step on the part of the property owners of Mesilla valley to mortgage their lands to the government in order to secure the building of the dam at Engle, N. M., to furnish land with water in New Mexico and along the Rio Grande in west Texas.

St. John, N. B.—Bids will be received at the office of the Common Clerk on Apr. 12 for the construction of the water works extension, to be let in 4 contracts, to consist of woodstave pipe line, a 39-in. reinforced concrete aqueduct, a 48-in. concrete aqueduct (part in tunnel) and a concrete masonry dam on Mispec River, as advertised in The Engineering Record.

Edmonton, N. W. Ter.—J. H. Hargreaves, City Engr., writes water works and sewer extensions to the extent of $125,000 are in contemplation, but nothing definite has yet been done.

Ft. Frances, Ont.—The citizens are reported to have voted to install a system of water works for fire protection.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—Bids will be received May 1 by the Bd. Supervs. for $443,600 sewer and $427,000 school bonds.

San Francisco, Cal.—It is stated that the Bd. of Pub. Wks. on Mar. 4 decided to recommend to the Bd. of Supervisors that the following work be ordered: Sewering of 4th from Howard to Channel, at an estimated cost of $75,000; sewering of Mission St., from 2d to the bay and the sewering of intersecting streets, $125,000; widening and repaving of Mission St., from the bay to 9th St., $125,000; widening and paving of 4th St. from Howard to Channel, $75,000; sewering Market St. at its lower end, $65,000; paving of Market St., $43,000, and sewering of H St., from 7th to 20th Aves., $14,000.

The Bd. of Pub. Wks. on Mar. 11 approved plans and specifications prepared by the City Engr. for a sewer in Mission and Amazon Sts., at an estimated cost of $15,000.

New Britain, Conn.—The City Sewer Dept. is reported to have under consideration the expending of $50,000 for sewer construction this spring.

East St. Louis, Ill.—See "Paving and Roadmaking."

Greensburg, Ind.—The question of constructing a sewerage system is reported under consideration here; probable cost, $100,000.

South Bend, Ind.—A. J. Hammond, City Engr., has completed his report on a trunk sewer along Bowman Creek; he estimates the cost at about $25,000.

Pipe sewers will be constructed in several streets.

Grinnell, Ia.—Bids are wanted Apr. 3 for furnishing material and constructing about 3,000 ft. 8-in. vitrified tile sewer in Elm and Summer Sts. J. F. Wilson, City Clk.

Harlan, Ia.—The question of constructing a sewerage system, to cost about $9,000, is reported under consideration.

Muscatine, Ia.—All bids opened on Mar. 9 for constructing the Papoose sewer extension have been rejected, and new bids will be received on Mar. 27. The lowest bid received was that of the Davenport Constr. Co., of Davenport, for $9,608.

Scottville, Mich.—Bids will be received Apr. 10 by the Village Bd. for constructing 6 to 15-in. sanitary sewers, in all about 2,100 ft. with necessary manholes and catch basins. W. C. Freedy, Village Clk.

**St. Paul, Minn.*—E. J. Kirkland is stated to have secured the contract for constructing sew-

**Items marked thus give the names of parties awarded contracts.*

ers on Summit, Finn, Lincoln and Grand Aves. for $15,200.

**Holly Springs, Miss.*—Gill & Co., of Chattanooga, Tenn., are stated to have secured the contract to construct a sewerage system here (bids opened Mar. 7). The work will consist of 4.3 miles of 8-in. pipe sewers, with septic tank, flush tank, manholes and other accessories.

Wilton, N. H.—This town voted on Mar. 14 to construct a house sewerage system, and appropriated $15,000 to pay for same. It also voted to extend the water system to Hillsboro Mills in Milford, and appropriated $3,000 for that purpose. Isaac S. Whiting, Chas. E. Weeks and Star B. Center were re-elected Water Comrs. and also authorized to construct the sewerage system. A. W. Dudley, 936 Elm St., Manchester, N. H., has been employed as engineer.

ing abolition, bridge, bathhouse, city farm and hospital improvements.

Columbus, O.—Bids will be received until Mar. 29 by the Bd. Pub. Service for constructing sanitary sewers in portions of several alleys. Chas. H. Frank, Secy.

Columbus, O.—The City Council has passed an ordinance providing for an issue of $17,000 bonds for constructing Section B of the Southside main sanitary sewer.

Springfield, O.—City Engr. W. H. Sieverling estimates the cost of constructing a sanitary sewer on Yellow Springs St., at $8,336; he estimates the cost of paving this street at $57,569.

Altoona, Pa.—City Engr. Harvey Linton is reported to have prepared plans for sewers to be laid in Millville; they provide for 25,570 ft. of 15, 12 and 8-in. pipe.

Dakotah, Ia.—It is reported that bids will be received until Apr. 5 by John Cunningham, Co. Aud., for constructing a bridge across Des Moines River, in Avery Township, to have 1 steel span, 140 ft. long.

Des Moines, Ia.—The following are the bids opened on Mar. 18 for the construction of two retaining walls of reinforced concrete and two reinforced arches, 70-ft. spans, for the 6th Ave. Bridge: John Dean & Co., Chicago, Ill., $26,200; J. F. Griffith & Co., Des Moines, $33,425; Marsh Bridge Co., Des Moines, $32,774; N. M. Stark & Co., Des Moines, $42,900; Des Moines Bridge & Iron Wks., Des Moines, $36,896; John Gilligan Co., Falls City, Neb., $31,988; W. F. Cook, Des Moines, $38,700; O. P. Herrick, Des Moines, $32,888; Christy Cons. Co., Des Moines, $33,000; Midland Bridge Co., Kansas City, Mo.,

Brooklyn, N. Y.—The following are the bids opened on Mar. 15 by Martin W. Littleton, Pres. Brooklyn Boro. for a sewer on 67th St. from 2d to 3d Ave., with outlet sewer on 3d Ave., etc. (bidders of Brooklyn, unless otherwise mentioned)—(*a*) Thos. O'C. Sloane, N. Y. City; (*b*) Donegan & Redmond; (*c*) Sigretto & Maurino; (*d*) T. J. Murray; (*e*) Jas. Reiley; (*f*) Murphy Bros.; (*g*) Jas. H. Holmes & Co.; (*h*) Borough Cons't Co; (*i*) Dewitt C. Bowker, Jr., Rockaway, L. I.; (*j*) Henry Newman.

Reinforced Concrete Sewer.	*a*	*b*	*g*	*d*	*e*	*f*	*c*	*h*	*i*	*j*
290 lin. ft. 42-in.	$14.05	$12.22	$15.00	$9.75	$20.00	$15.50	$15.00	$15.75	$10.75	$15.30
266 lin. ft. 36-in.	5.44	5.70	7.00	8.75	9.00	6.90	6.30	7.25	9.00	6.75
1665 lin. ft. 30-in.	4.78	4.75	6.00	7.90	8.00	6.44	5.30	6.25	6.80	5.95
Pipe Sewer.										
45 lin. ft. 15-in.	1.60	2.50	3.00	3.00	2.00	2.48	1.20	3.00	2.00	2.40
710 lin. ft. 12-in.	1.30	1.40	2.00	1.40	1.50	1.70	1.20	1.25	2.00	1.10
27 manholes	40.00	42.00	45.00	57.00	40.00	45.00	45.00	50.00	55.00	40.00
.5 sewer basins.	121.00	135.00	100.00	140.00	130.00	150.00	115.00	140.00	155.00	108.00
13.5 M. ft. foundation plank.	20.00	20.00	19.00	20.00	.01	20.00	18.00	20.00	.01	18.00
54 cu. yds. concrete cradle.	5.00	.01	5.13	8.00	.01	2.50	.01	1.00	.01	2.05
	$16,700	$16,155	$17,790	$20,299	$20,604	$19,002	$20,006	$22,378	$24,400	$20,742

Haddonfield, N. J.—Allen Clymer, Boro. Clk., writes that it is proposed to construct sewers in the annexed district on several streets. W. W. White, of White Plains, N. Y., is making the preliminary survey.

Madison, N. J.—The Sewerage Com. is reported to have recommended that the sewage be carried to a point in the lower end of the town and there purified. A plan for the es-

**Toledo, O.*—Contracts for sewers are stated to have been awarded on Mar. 8 by the Bd. of Pub. Service, as follows: To Henry P. Streicher, for the Columbus St. sewer, at $88,440, and O'Neill & Tansey, for the sewer in Oakdale Ave., for $104,015.

Sayre, Pa.—The Boro. Council is stated to have decided to employ a sanitary engineer to prepare plans and estimates for a sewerage system.

$44,560, and Wm. Horrabin, Iowa City, $29,900.

**Zona, La.*—The Texas Bridge Co., Dallas, Tex., has secured the contract for a bridge over Bogue Chitto River, at Zona, for $7,250; it will consist of one 200-ft. span and one 60-ft. span over Silver Creek, the parish to build wood approaches.

Springfield, Mass.—Bids will be received by the Comrs. of Hampden County (Robt. O. Mor-

**Lorain, O.*—C. B. Foley, Asst. City Engr., writes that the following are the bids opened on Mar. 11 by the Bd. of Pub. Service for constructing brick sewers—(*a*) McCracken & Co., Cleveland (awarded contract); (*b*) Penney & Corron, Lorain; (*c*) Jas. Duff & Co., Cleveland; (*d*) Faragher & Randall, Lorain; (*e*) Beers & Doolittle, Cleveland; (*f*) McManis & Russell, Cleveland; (*g*) W. J. Townsend & Co., Cleveland; (*h*) W. J. Gawn, Cleveland; (*i*) Ohio Eng. Co., Lorain.

Brick Sewer.	*a.*	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*i.*
800 Lin. ft.—6 ft.	$9.82	$11.05	$14.00	$12.00	$13.26	$11.55	$11.50	$11.70	$15.00
580 Lin. ft.—5½ ft.	8.00	10.61	8.00	11.00	9.05	10.58	10.70	10.90	12.00
1920 Lin. ft.—5 ft.	7.40	10.30	8.00	9.00	8.00	9.72	8.55	10.10	9.50
75 Lin. ft.—30 ft.	2.50	2.61	4.00	5.00	4.80	3.45	....	6.00	6.50
10 Man holes	35.00	35.00	38.00	75.00	36.00	45.00	35.00	30.00	40.00
1 Complete—Grating and inlet (brick)	50.00	200.00	100.00	25.00	194.00	200.00	100.00	125.00	100.00
1 Complete—Outlet—stone	165.00	280.00	275.00	300.00	215.00	370.00	100.00	150.00	150.00
1 Complete—Overflow chamber—Brick sewer in No. 3	250.00	300.00	175.00	200.00	402.00	300.00	150.00	500.00	170.00
1 Complete—Overflow chamber—Brick sewer in No. 2.	200.00	250.00	175.00	200.00	415.00	200.00	150.00	500.00	140.00
Total	$27,906	$36,346	$31,907	$35,110	$33,249	$35,818	$32,572	$37,099	$39,647

Asbury Park, N. J.—John L. Coffin, Supt. Dept. Water and Sewers, writes in regard to the construction of the sewage disposal plant, that the probable cost of the work is $35,000 to $40,000. The matter of issuing the bonds is to be submitted to a vote. It is probable that nothing will be done this year except the laying of 4,000 ft. of 18-in. intercepting sewer and 1,000 to 1,200 ft. of discharge pipe, the latter extending that far into the ocean. Engineer, F. Herbert Snow, 1120 Tremont Bldg., Boston, Mass.

**Hackensack, N. J.*—E. C. Humphrey, of Hackensack, is reported to have secured the contract for the Bogota sewer; probable cost, about $10,000.

tablishment of septic tanks and filter beds is endorsed. It further reports that an engineer be employed to prepare plans and specifications; also that the matter be brought before the voters.

Newark, N. J.—Engr. Edw. S. Rankin, of the Dept. of Sewers and Drainage, is stated to have submitted to the Bd. of Wks. a report on sewers proposed for the Silver Lake section of the city. Three plans have been considered; 1st to connect with the Orange outlet sewer in Mill St., Belleville; 2d to connect by a gravity line with some existing Newark sewer and 3d to establish a small pumping station at N. 6th St. and old Bloomfield Road in order to lift the sewage and discharge it into the Forest Hill main on 2d St.; the engineer favors the 3d plan which would cost about $27,000.

Hempstead, L. I., N. Y.—The Town Highway Comrs., are reported to have granted the Nassau Sewerage Co. a franchise for 99 years, subject to approval of the Supervisors, to lay pipes on town roads leading to Roosevelt and Freeport; to and through Baldwin, Ocean Side and Lynbrook, to Rockville Centre and East Rockaway.

Local press reports state that an agreement has about been reached between Solicitor Hunt, City Engr. Breen, of this city, and City Engr. Stewart, of Norwood, by which Norwood will be allowed to connect its sewerage system with the proposed Bloody Run sewer, to be constructed from its present terminus to Millcreek, provided that Norwood will take care of the sewage from the east end of Cincinnati. A bond issue will be required to pay for the new Bloody Run sewer, which will cost about $225,000.

Long Island City, L. I., N. Y.—Bids will be received Apr. 3 by Jos. Cassidy, Pres. Boro. Queens, for furnishing and delivering to Bureau of Sewers, 2,200 lin. ft. 15, 18, 24 and 30-in. vitrified salt-glazed sewer.

Spencer, N. C.—See "Water."

Cambridge, O.—Bids are wanted Apr. 17 for $5,000 sewer bonds. T. R. Deselm, City Aud.

Cincinnati, O.—Bids will be received Mar. 31 by the Bd. Pub. Service for furnishing material and constructing sewers and drains in portions of Providence and Oliver Sts. Geo. F. Holmes, Clk.

Cleveland, O.—Local press reports state that bids will be received until Apr. 6 by City Aud. Madigan, for $2,751,000 municipal bonds, to be used for sewer, street improvements, grade cross-

Providence, R. I.—Bids will be received Mar. 27 by Dept. Pub. Wks. (Walter F. Slade, Comr.) for constructing 1,865 ft. 70-in. and 2,234 ft. 84-in. brick and concrete sewer in Section 31, Pleasant Valley Division; 500 ft. 26 and 36-in. brick storm sewer in right of way from Valley St. to Woonasquatucket River; 855 ft. 24 and 32 in. brick and 1,062 ft. 12 and 15-in. pipe sewer in Narragansett Ave., and right of way from city line to main trunk sewer in Section 8; 2,776 ft. 8, 12 and 15-in. pipe sewer in Elmdale and Eastwood Aves., Whitehall and Cleveland Sts.; 1,449 ft. 8 and 12-in. pipe sewer in Reynolds Ave., Wadsworth and Grand Sts., and 970 ft. 8 and 12-in. pipe sewer in Linton and Robin Sts. The brick, pipe, cement, iron, flagstones and granite will be furnished by the Comr. Pub. Wks.

Ogden, Utah.—The City Council has ordered published a notice of intention to build sewers, at an estimated cost of $110,000. The question will be submitted to a vote. A. F. Parker, City Engr.

Amherst, Va.—L. S. Randolph, Consulting Engr., Blacksburg, Va., writes that it is proposed to construct a sewerage system and sewage disposal plant for Sweet Briar Institute; probable cost $3,000.

Puyallup, Wash.—Robt. Wilson, City Clk., writes that bids will probably be received about Apr. 15 for constructing sewers in "Dist. A," to cost about $27,000. Engineers, Dunn, Coale & Dunn, Lumber Exchange, Seattle.

**Spokane, Wash.*—The Bd. of Pub. Wks. is reported to have awarded the contract for a sewer on Pacific Ave., and for lateral sewer connections, to J. C. Broad, 106 Post St., for $12,965.

Tacoma, Wash.—Comr. of Pub. Wks. Welsh is stated to have completed plans and specifications for a sanitary sewer at head of the bay. The sewer, as planned, will start beyond the railroad tracks on East H and 27th Sts. About 2,000 ft. of 18-in. pipe will be required in the construction of the new sewer; probable cost,

BRIDGES.

Notes Arranged Alphabetically by States.

Denver, Colo.—Bids will soon be asked by the Bd. of Pub. Wks. for a 2-span reinforced concrete bridge over So. Platte River at Colfax Ave., with 40-ft. roadway and 10-ft. sidewalks on either side; length, 140 ft. Bidders to submit their own designs.

Washington, D. C.—J. E. Greiner, of Baltimore, Md., Engr. Bridges and Bldgs. Baltimore & Ohio R. R. Co., is reported to be preparing plans for a bridge to be constructed on New York Ave., to cost $175,000.

Bloomfield, Ind.—Press reports state that bids will be received Apr. 8 by Wm. H. Deckard, Co. Aud., for $11,000 bridge bonds.

Lafayette, Ind.—Plans for a bridge, 125-ft. span, with concrete floor, are being prepared. G. H. Stevenson, County Surveyor.

Middletown, Ind.—Press reports state that bids will be received Apr. 4 by the Co. Comrs. at Newcastle for constructing a 100-ft. span bridge south of Middletown.

ris, Clk.) on Apr. 8 for furnishing and erecting the metal work of the highway bridge over Connecticut River, bet. Chicopee and West Springfield, as advertised in The Engineering Record.

Grand Rapids, Mich.—City Engr. Anderson is stated to have estimated the cost of constructing viaducts over the net-work of railroad tracks running from the Union depot through the heart of the 1st Ward, as follows: A concrete steel viaduct at Wealthy Ave., $80,250; viaduct at Bartlett St., $88,308, and footbridge at Bartlett St., from Ellsworth to Division Sts., $21,624.

Anoka, Minn.—Bids will be received Apr. 7 by the Bd. Co. Comrs. for constructing 50 new approaches with concrete or stone abutments, at each end of St. Francis bridge over Run River; bids to be for steel, concrete, wood or combination. Arthur A. Caswell, Co. Aud.

Hutchinson, Minn.—It is reported that bids are wanted Mar. 29 for constructing a 51-ft. riveted steel truss bridge over Crow River. Henry Baun, City Clk.

Townsend, Mont.—Bids will be received Apr. 10 by the Bd. Co. Comrs. for constructing a steel or combination bridge over Missouri River at Townsend. Wm. Schreiner, Clk.

**Gouverneur, N. Y.*—The following are the bids opened on Mar. 20 for a highway bridge over the Oswegatchie River at Gouverneur: Acme Road Machinery Co., Frankfort, N. Y., $25,292; Lewis Shoemaker & Co., Philadelphia, Pa., $20,963; Milliken Bros., New York, $19,865; York Bridge Co., York, Pa., $18,100; Groton Bridge Co., Groton, $18,000; Hodge & Co., Watertown, $17,537; Berlin Construction Co., Berlin, Conn., $17,450; Seneca Engineering Co., Montour Falls, $16,850; Penn Bridge Co., Beaver Falls, Pa., $16,750; Climax Road Machine Co., Marathon, $16,400; Baltimore Bridge Co., Baltimore, Md., $16,154; United Construction Co., Albany, $15,995; Canton Bridge Co., Canton, O., $15,000; Ellery Colby & Co., Owego, $15,500; New Jersey Bridge Co., N. Y. City, $15,375, and Owego Bridge Co., Owego, $14,980 (awarded contract).

Devil's Lake, N. D.—It is reported that bids will be received until Apr. 3 by the Co. Comrs. for constructing 4 steel bridges. Address Co. Auditor.

Cincinnati, O.—Bids will be received until Apr. 21 by the Co. Comrs. for crushed stone on the approaches to the suspension bridge over Whitewater River, Whitewater Township. Eugene L. Lewis, Co. Aud.

Cleveland, O.—See "Sewerage and Sewage Disposal."

Cleveland, O.—Bids will be received until Apr. 12 by the Co. Comrs. for constructing several steel bridges throughout the county. Julius C. Dorn, Co. Clk.; Wm. H. Evers, Engr.

Dayton, O.—Bids will be received until Apr. 4 by the Bd. Pub. Service for furnishing material and constructing abutment walls and for the erection of the superstructure of a bridge across Wolf Creek at Summit St., as advertised in The Engineering Record.

Jackson, O.—It is stated that bid
ceived until Apr. 13 by W. J. S
Aud., for furnishing material and
the substructure and superstructur
bridges, together with a number of
sewers, all of which are to be made
J. W. Turner, Co. Surv.

Toledo, O.—It is proposed to re
beams, replank the floor, thorough
metal and paint Cherry St. bridge,
3$1,000. F. I. Consaul, City Engr.

Portland, Ore.—It is stated that
will soon be let for improvements
side St. bridge, probable cost of i
$15,000.

Tillamook, Ore.—Bids will be r
Apr. 10 by the Co. Court (G. B.
for constructing a bridge across Nc
River, in Tillamook County.

Goldbeach, Ore.—It is stated th
wanted Apr. 5 by the Co. Comrs. f
the main span of the Elk River bridg
Smith, Co. Clk.

Weatherly, Pa.—The construction
over Black Creek is reported unde
tion, at a cost of $6,000.

Houston, Tex.—A. Lipper, City
that a committee has been appointe
gate the matter of constructing a
Main St.

PAVING AND ROADMAKI

Notes Arranged Alphabetically

Little Rock, Ark.—It is proposed t
vitrified brick 17 blocks on Center
blocks on E. 9th St.

San Francisco, Cal.—See "Sew
Sewage Disposal."

San Francisco, Cal.—The Bd. of
is stated to have decided to repair a
minous rock pavements on numero
and, according to reports, the Clerk
instructed to receive bids for the sa

Palo Alto, Cal.—It is stated that es
being prepared by City Engr. J. F.
for street improvements amounting t

Ormond, Fla.—It is stated that a
6 miles long will be constructed be
mond and Seabreeze for automobile
M. Flagler is reported interested.

Canton, Ill.—It is stated that abou
of W. Walnut St. will be paved, at a
cost of $15,250.

Chicago, Ill.—Bids will be receive
by the Bd. Local Improv. for grading
ing with granite blocks certain alley
curbing and paving with asphalt a
Sherman Pl.; also paving with creosot
blocks, 3, 4, 6 and 9 in. limeston
vitrified brick and granite blocks,
numerous streets. John A. May, Sec

East St. Louis, Ill.—The City Coun
ed to have passed an ordinance pro
the paving with brick and construct
on a portion of 2d St., at an estima
$27,300.

Bedford, Ind.—Bids will be rece
2 by the Bd. Co. Comrs. for construc
and macadamized roads in Pleasant
ship, in all about 54,834 ft. Walter
Co. Aud.

Indianapolis, Ind.—Bids will be rec
27 by the Bd. Pub. Wks. for im
grading and paving sidewalks with
portions of several streets; also fo
graveling and rolling roadways, gradin
ing sidewalks with cement in portio
and Lasalle Sts. M. A. Downing,

**Jacsonville, Ind.*—Chas. Davis, of
is stated to have received the contract
ing about 13 miles of road here for

Lafayette, Ind.—It is stated that
wanted Apr. 10 by the Common Coun
proving a portion of Schuyler Ave.,
and 10th Sts. E. H. Andress, Jr., C

Marion, Ind.—Bids are wanted A
grading, curbing and paving with vit
a portion of 1st St. John O. Willson

Paoli, Ind.—It is stated that bids
ed Apr. 5 by the Co. Comrs. for c
roads in Stampers Creek Township.
Ham, Co. Aud.

South Bend, Ind.—Plans are bein
for about 60,000 sq. yds. of brick p
J. Hammond, City Engr.

Sullivan, Ind.—It is reported that
be received Apr. 15 by the Bd. Co.
constructing about 20.5 miles of ston

**Rensselaer, Ind.*—Jas. N. Leathe
Aud., writes that the contract for c
5½ miles of gravel roads (bids opene
has been awarded to H. H. Stewart
Kokomo, for $14,641.

Des Moines, Ia.—The lowest bid
Mar. 14 for sidewalks for the year
submitted by Frank W. Hunt, at 10
sq. ft. for cement and 7 9/10 cts.
for brick.

New Orleans, La.—Martin Behrma
on Mar. 16 approved the ordinance
the City Comptroller to procure bids
taining asphalt pavements for 3 yrs.
ous streets of this city.

Long Island City, L. I., N. Y.—B
received Apr. 3 by Jos. Cassidy, F
Queens, for regulating, grading, cu
ing, and repaving with asphalt a porti
ton St. Engineer's estimate: 22,700
phalt, including binder course, 3,500 c
crete, 6,000 lin. ft. new bluestone curb
and set, and granite block pavement.

Baltimore, Md.—Bids will be rece
29 by the Bd. of Awards for rep
creo-resinate processed wood blocks
Fayette, Calvert and St. Paul Sts
Paul St. Plaza. E. Clay Timanus, F

Detroit, Mich.—Bids will be rece
Mar. 31 by the Dept. Pub. Wks. for
erecting and equipping complete read
ation on land furnished by the city,
the making of brick for paving purp
owned and operated by the city. B

**Items marked thus give the names of parties awarded contracts.*

plants of 20,000 and 30,000 ca-
ily, and will be required to fur-
plans and specifications. Wm.
omr.

Mich.—Harry M. Bush, City
at contracts for paving (bids
have been awarded as follows:
id Trinidad Paving Co., of Cleve-
asphalt, at $1.80 per sq. yd., and
Prange, of Grand Rapids, Mich.,
metropolitan brick, at $1.74 per
ds for this work were previously
13, and rejected; the prices be-
n the issue of The Engineering
. 25.

ch.—City Engr. H. A. Collar is
estimated the cost of paving a
ıd St. at $6,300.

Minn.—Ellis R. Dutton, Asst.
ites that bids will be received on
he following material, for paving
struction in 1905: Cedar blocks,
; sandstone blocks, 30,000 sq. yd.;
s, 30,000 sq. yd.; crushed slate,
granite curb, 2,000 ft., and sand-
000 ft. Bids for 40,000 sq. yd.
k will be received on Apr. 14.

ss.—It is stated that about $10,000
ded on street improvements.

Miss.—It is stated that bids will
ntil Apr. 30 by J. D. Laughlin,
of Warren County, for repairing

, *C.*—See "Water."

V. J.—The following bids are stat-
een opened on Mar. 15 by the City
bout 8,370 sq. yd. trap rock pave-
d foundation on a portion of 3d
Callahan, $16,078; J. F. Dolan,
J. Potts, $16,748; Patrick Faulk-
Wm. J. McCloud, $17,615, and
Rosa, $17,545.

N. Y.—Bids are wanted Apr. 4
Market and Bridge Sts., 6,600 sq.
-clay paving blocks on a concrete
as advertised in The Engineering

Y.—The Aldermanic Com. on
ated to have on Mar. 9 reported
the following bids for street pav-
ock stone, William St., Johnson &
; repaving with Medina sandstone,
V. E. Bardol, $9,800, and Seneca
sphalt Paving Co., 880 Ellicott Sq.,

be received until Apr. 4 by the
Vks. (Francis G. Ward, Comr.), for
ortions of several streets and for
rtion of Spruce St.

n, N. Y.—The paving with brick
pal thoroughfare in Cooperstown is
der consideration; probable cost,

Y.—It is stated that bids will be
Apr. 3 by the Bd. Pub. Wks. for
a portion of Tompkins St.

r, N. Y.—Bids are wanted Apr. 10
g roadway at this post. Address
Miller, Q. M.

N. Y.—The Bd. of Aldermen have
ordinance providing for the issue
Corporate Stock for repaving in
Manhattan, Brooklyn and Rich-

N. Y.—Bids will be received Mar.
F. Ahearn, Pres. Boro. Manhattan,
g and repaving with asphalt por-
eets, and with asphalt block a por-
Nicholas Ave.; for regulating and
asphalt block portions of Audubon
rth Aves.; for paving and repav-
nite block portions of Watts, 54th,
ancey Sts.; also for flagging, curb-
urbing sidewalks on portions of
ues and streets in Boro. Manhat-
er's estimate: 35,500 sq. yd. asphalt,
der course; 35,460 sq. yd. old
nt, relaid as foundation or in ap-
820 sq. yd. new granite block, in-
l-bed, laid with paving cement
sq. yd. asphalt block, 1,789 sq.
21,235 lin. ft. new bluestone curb,

V. Y.—Bids will be received Mar.
l. Contract and Supply for furnish-
and paving portion of Mark Ave.
n St. with asphalt sheet or block,
brick or block; requiring a main-
antee of 10 years. Geo. J. Metz,

Y.—Bids will be received Mar. 28
Contract and Supply for furnishing
ding, curbing, regulating and pav-
rified brick with cement joints on
dation, a portion of 15th St.; re-
lin. ft. curb, 7,700 sq. yds. brick
6 in., and 2,100 sq. yds. brick
9 in. concrete foundation. Jas.
k.

ins, N. Y.—Bids will be received
he Bd. Village Trus. for grading,
ging and constructing Telford gut-
ico Ave. J. Henry Carpenter, Vil-
Central Bank Bldg.; Peter Pauld-

O.—See "Sewerage and Sewage

reen, O.—Bids will be received Apr.
Comrs. for grading, draining, mac-
d constructing an earth or dirt road
macadam roadbed on P. P. Swinehart,
d O. W. Foster Roads; also on
similar work on J. A. Stebel and
is, Jerry Carter and Geo. Foos
Spafford, Co. Surv.

Bucyrus, O.—Bids will be received until Apr. 26 by W. H. Jams, City Aud., for $19,200 bonds, issued for the purpose of redressing, curbing, grading and preparing roadbed of a portion of Sandusky Ave.

Cincinnati, O.—The Barber Asphalt Paving Co. is stated to have submitted the lowest bid for resurfacing with asphalt a portion of 8th St. (bids opened Mar. 3).

Bids will be received until Apr. 21 by the Co. Comrs. for improving a portion of Section Ave. in Sycamore Township. Eugene L. Lewis, Co. Aud.

Cincinnati, O.—Bids will be received Apr. 10 by the Bd. Pub. Service for furnishing material and improving a portion of E. 12th St. by grading, curbing and paving with asphalt; bids will also be received Apr. 14 for improving a portion of Vine St. by grading, curbing and paving with granite block. Geo. F. Holmes, Clk.

Bids will be received until Apr. 17 by the Bd. Pub. Service for furnishing material and improving a portion of Race St. by resurfacing with asphalt, etc. Geo. F. Holmes, Clk.

Columbus, O.—City Council is stated to have passed an ordinance providing for an appropriation of $34,000 for a macadam roadway, being an extension of Dublin pike.

Dayton, O.—Bids will be received Mar. 31 by the Bd. Pub. Service for grading and graveling portions of Meredith St. and Edgewater Ave. Wm. F. Miller, Clk.

**Elyria, O.*—Scott Hemmen, Clk. Bd. Pub. Service, writes that the contract for furnishing material and paving a portion of Washington St. with asphalt (bids opened Feb. 27) has been awarded to Warren Bros. Co., of Boston, Mass., for $22,775.

Greenville, O.—It is stated that bids will be received until Mar. 31 by A. T. Knoor, Village Clk., for improving a portion of Pine St. by grading, curbing and graveling.

Massillon, O.—J. U. Douglass, City Aud., writes that about $40,000 will be expended for block paving.

Piqua, O.—Bids are wanted Apr. 3 for $19,000 paving bonds. Bert A. Reed, City Aud.

Portsmouth, O.—The City Council on Mar. 15 passed resolutions to pave Washington St., 2,766 ft. in length; 9th St., 530 ft. in length (one square), and 11th St., from Washington St., 600 ft. (one square); total about 3,900 ft.

Springfield, O.—See "Sewerage and Sewage Disposal."

Warren, O.—It is reported that bids will be received until about Apr. 3 by the Co. Comrs. for $58,000 county road bonds.

Uhrichsville, O.—H. O. Snyder, City Clk., writes that bids will be received on Apr. 10 for paving W. 3d St. with firebrick; probable cost, $18,580.

Braddock, Pa.—Bids will be received Apr. 10 by L. L. Todd, Boro. Secy., for the purchase of $132,000 bonds, part of which to be used for street improvement.

Philadelphia, Pa.—Bids will be received Mar. 28 by the Com. on Property at the office of Bd. Pub. Educ. for paving yards at Lynd School. A. F. Hammond, Secy.

Cookeville, Tenn.—O. Holladay, City Recorder, writes that bids for paving will be received about Apr. 15.

Ft. Myer, Va.—Bids will be received by Lieut. Edw. P. Nones, Constr. Q. M., U. S. A., on Apr. 1 for constructing roads and concrete walks in the vicinity of the Post Hospital as advertised in The Engineering Record.

Dayton, Wash.—Press reports state that bids will be received Apr. 3 by the Co. Comrs. for constructing cut-off road from to top of at head of Patit; road to be about 2½ miles long, with probably ½ mile of rock work.

**Spokane, Wash.*—Peter Costello is stated to have received the contract for grading and constructing sidewalks on a portion of 4th Ave., for $9,000.

Plans are stated to have been prepared for paving with brick and constructing sidewalks on a portion of 7th Ave., at a cost of $8,979.

Tacoma, Wash.—The following bids are stated to have been opened Mar. 11 by Comr. of Pub. Wks. for constructing cement sidewalks in the Wright Park District: F. A. Keasal, $20,670; Cornell Bros., $20,873; Jas. Lee, $20,793; B. W. Kibler, $18,960; E. M. More, $20,300; G. M. Savage & Co., $18,961; Tunnard & Chamberlain, $21,333.60; P. E. McHugh, $19,970, and M. W. Kelty, of Seattle, $19,974. (Bidders of Tacoma, unless otherwise mentioned.)

La Crosse, Wis.—The Bd. of Pub. Wks. is stated to have opened the following bids Mar. 13 for paving portions of Main, 3d, 4th Sts. and several alleys—1, with Berea curb; 2, with Kettle River curb; *a*, with Metropolitan brick; *b*, with Canton block; *c*, with Purington block; *d*, with Nelsonville block; *e*, with Collingwood block: Northwestern Constr. Co., *a* 1, $58,750; *a* 2, $60,350; *b* 1, $57,500; *b* 2, $59,100; *c* 1, $51,499; *c* 2; $52,875. Wooley & Hanson, *d* 1, $56,700; *d* 2, $57,450; *e* 1, $56,675; *e* 2, $57,425; *c* 1, $55,650; *c* 2, $56,650. La Crosse Stone Co., *a* 1, $63,100; *b* 1, $62,000; *b* 2, $62,400; *c* 1, $51,458; *c* 2, $51,833. Fielding & Shepley, of St. Paul, Minn., *a* 1, $56,350; *a* 2, $56,600; *c* 1, $53,370; *c* 2, $53,600. Groff & Derr, *b* 1, $55,640; *b* 2, $55,670; *c* 1, $56,397; *c* 2, $52,207 (bidders all of La Crosse unless otherwise mentioned).

Racine, Wis.—The La Crosse Stone Co., of La Crosse, is stated to have submitted the lowest bid for paving with brick here, at $1.45½ per sq. yd.; total cost of proposed improvement is $35,000.

Superior, Wis.—The Common Council is reported to have authorized the Bd. of Pub. Wks. to receive bids for paving Broadway, at a probable cost of $45,000.

Acton, Ont.—Bids are wanted Apr. 1 for constructing macadam streets in village. T. T. Moore, Village Clk.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Luverne, Ala.—The Luverne Electric Light & Water Co., of Luverne, is reported incorporated, with a capital of $10,000, by J. R. Horn, J. M. Cody, R. G. Reddach, and others.

Ocean Park, Cal.—It is stated that bids will be received until Apr. 10 by the Bd. of Trus. for the purchase of a franchise to lay gas pipes. Dana Burke, Pres.

Santa Barbara, Cal.—The City Council is reported to have granted a franchise to the Merchants' Mutual Electric Light & Power Co.

Sebastopol, Cal.—The Sebastopol Light, Power & Water Co. is reported incorporated, with a capital of $25,000, by W. P. English, G. W. Kingsbury, and A. B. Swain, of Sebastopol.

Modesto, Cal.—It is stated that the Tuolumne Electric Co. has applied for a franchise to construct poles and string wires along the county roads for transmitting electric current, and, it is reported, that bids for said franchise will be received until May 2. J. B. Doyle, Co. Clk.

Cheshire, Conn.—This town is reported to have appointed a committee to investigate the cost of constructing a municipal electric-light plant.

Washington, D. C.—Bids will be received Apr. 11 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at the navy yards, Mare Island, Cal., and Puget Sound, Wash., a quantity of electric wire, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

The following are the bids opened on Mar. 20 by the Comrs. D. C. for constructing an electric generating plant at the sewage pumping station, consisting of one 35-kw. and two 75-kw. 250-volt generators, direct current, with compound engines and condensers and auxiliary equipment: Malcolm W. Hill & Co., Baltimore, Md., $10,490; D'Olier Eng. Co., Philadelphia, Pa., $12,300; Mackay Eng. Co., New York, N. Y., $13,305; W. W. Sheehan, New York, N. Y., $13,768; Wallace Stebbins & Sons, Baltimore, Md., $14,655; McCay Eng. Co., Baltimore, Md., $15,490; Bellmar & Sanford, New York, N. Y., $15,635; M. R. Muckle, Jr., & Co., Philadelphia, Pa., $15,900; National Electrical Supply Co., Washington, D. C. (3 bids), $16,089, $17,334 and $19,789; Johnston Livingston, Jr., & Co., New York, N. Y., $17,800.

Indianapolis, Ind.—Bids will be received Apr. 4 at the Treas. Dept., Washington, D. C., for furnishing and installing certain electric and gas fixtures in U. S. Court House and Post Office here. H. A. Taylor, Acting Secy.

Lyons, Kan.—The Lyons Electric Co. is reported organized here, and has secured a 20-yr. franchise to construct an electric-light and power plant. An engineer has been selected to install and operate the plant.

Marseilles, Ill.—See "Water."

Connersville, Ind.—The general gas, electric-light and power plant at this place is reported to have been sold to Geo. B. Markle, of Hazleton, Pa., who will expend a considerable sum in improvements.

Ligonier, Ind.—Bids will be received until Apr. 27 by Fred. H. Green, Mayor, for lighting the city by electric light for a term of 10 years from Nov. 1, 1905, with 40 or more 2,000-c.p. inclosed arc lamps; also for furnishing an incandescent system of electric lighting, and a system of commercial arc lights for business houses and residences for the same term of years, as advertised in The Engineering Record.

Muskogee, Ind. Ter.—D. W. Bolick, Ch. Engr., writes that the Muskogee Grand River Power Co. has been incorporated, to construct a water-power plant of 40,000-h.p. on Grand River, about 11 miles from Muskogee. Surveys have been started, but nothing has been done as yet in the way of definite plans, maps, etc. C. N. Haskell, Pres.; Carl Pursell, Secy., both of Muskogee.

Charles City, Ia.—Brown & Wortham are reported interested in the construction of a gas plant.

**Baltimore, Md.*—The contract for lighting the city with electricity for 5 yrs. has been awarded to the Consolidated Gas, Electric Light & Power Co., at $67.49 per lamp per yr.

Baraga, Mich.—The State Legislature is reported to have passed a bill allowing this village to issue $40,000 bonds, for electric lights and water works.

Pontiac, Mich.—E. E. Hymers is stated to have petitioned Council for a franchise for a central heating plant.

Morristown, Minn.—The City Council is reported to have decided to construct a gas plant.

Fergus Falls, Minn.—The City Council and Electric Light Comn. are stated to have decided to rebuild the dam which supplies the city's electric-light plant with power. It is proposed to construct a cement dam, at a cost of $40,000.

Ackerman, Miss.—T. F. McGee is reported interested in the construction of an electric-light plant.

Meridian, Miss.—Press reports state that bids will be received at the May meeting of the Aldermen and Council, for a 50-year franchise for a gas plant.

Rosedale, Miss.—It is stated that a committee will procure estimates on the cost of an electric-light plant, to be operated in connection with the municipal water works.

Hattiesburg, Miss.—The City Council is stated to have granted a franchise for a gas plant to J. L. Kearney, of Hattiesburg; H. L. McKee, of Meridian, and H. A. Camp, of Lumberton.

New Albany, Miss.—The time for receiving bids for constructing a water works and electric light plant has been extended from Mar. 28 to Apr. 6, as advertised in The Engineering Record.

Fairmont, Neb.—It is stated that bids will be received until Apr. 1 by Jos. Jackson, City Clk., for installing gas works system and distributing mains and connections.

Alma, Neb.—A. A. Billings, City Clk., writes that bids will be received on Mar. 28 for the purchase of $15,000 water bonds and $2,500 electric light bonds. He further states that no engineer has as yet been selected and propositions for the position will be received up to Apr. 15.

Clinton, N. Y.—The Governor has signed the bill authorizing this city to issue $7,000 bonds for an electric light plant.

New York, N. Y.—Mayor McClellan on Mar. 17 ordered all bids rejected recently received for lighting the streets and public buildings.

Brooklyn, N. Y.—Bids will be received Apr. 3 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing electric equipment in school No. 85.

Brooklyn, N. Y.—Bids will be received Apr. 4 by John McG. Woodbury, Comr. Street Cleaning, N. Y. City, for installing electric work in stable on Flushing Ave., Graham and Little Nassau Sts.

Freeport, L. I., N. Y.—The Village Trus. are stated to have granted Geo. McDonald, of the South Shore Gas Co., a franchise for a gas plant. John R. Lee, of Paterson, N. J., is president of the company.

**Spencer, N. C.*—The Bd. of Aldermen is stated to have awarded to the Salisbury & Spencer St. Ry. Co. the contract to install a system of electric lights in Spencer, to be in operation by May 15.

Warren, O.—Albert S. Allen, of Cleveland, is stated to have been directed to prepare plans for a water and light plant for the Trumbull County court house and jail.

Springfield, O.—Local press reports state that if the E. S. Kelly Home Htg. Light & Power Co. secures a blanket franchise it will expend $50,000 this year in improvements.

Maumee, O.—The Public Service Co., of Maumee, is reported incorporated, with a capital of $50,000, for electric lighting and heating purposes. Incorporators: Geo. McGovern, Jas. H. Ragan, Thos. H. Harper, and others.

Dayton, O.—The Montgomery County Electric Co. has been incorporated with a capital of $100,000, by Robt. R. Neven, Fred A. Funkhouser, and others, to furnish electricity for light, heat and power purposes.

Philadelphia, Pa.—Bids will be received Mar. 28 by the Com. on Property at the office of Bd. Pub. Educ. for gas and electric fixtures for Northeast Manual Training School. A. F. Hammond, Secy.

Greenville, S. C.—A charter has been granted to the Saluda River Power Co., with a capital of $300,000. It is proposed to develop power 5 miles from this city, to supply textile and industrial enterprises. Lewis W. Parker, A. G. Furman and H. J. Hayneworth are the incorporators.

Cookeville, Tenn.—O. Holliday, City Recorder, writes that bids will probably be received on Apr. 15 for the construction of water works and an electric-light plant, at a cost of $25,000.

Roswell, N. M.—The Citizens' Light, Heat & Power Co., of Roswell, has been incorporated, with a capital of $100,000. J. A. Buckley, of Kingfisher, Okla. Ter., is one of the incorporators.

Toronto, Ont.—The City Engr. is stated to have submitted to the Bd. of Control a report on the installation of a municipal electric light plant. He estimates the cost at $638,000.

Rio de Janeiro, Brazil.—The Rio de Janeiro Tramway Light & Power Co. is reported organized, with a capital of $25,000,000, by Sir Wm. Van Horne, of Montreal, Que.; Wm. MacKenzie, of Toronto, Ont.; Percival Farquhar, of New York, N. Y., and others, to develop water power near Rio de Janeiro, and transmit the electric current to that city for lighting, the operation of street railways, and for industrial purposes.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—The Little Rock & Hot Springs Electric Ry. Co., with a capital of $2,000,000, is reported incorporated. C. J. Kramer, Pres.; J. C. Marshall, Sec.; Geo. W. Rogers, Treas., all of Little Rock.

Los Angeles, Cal.—It is reported that bids will be received Apr. 10 by H. J. Lelande, City Clk., for an electric railway franchise.

Monterey, Cal.—M. V. McQuigg, Pres. of the Monterey County Gas & Electric Co., is stated to have secured a franchise to build, equip and operate an electric railway for passenger and freight traffic between Monterey and Salinas. The distance is 12 miles in an air line, but about 24 miles by the existing railroad lines. He asks for a bonus of $50,000 for the purchase of rails, and also for a 50-ft. right of way. The estimated cost of the road is $300,000, and it is to be in operation early in 1906.

**Items marked thus give the names of parties awarded contracts.*

National City, Cal.—It is reported that bids will be received Apr. 6 by Geo. W. Grant, City Clk., for an electric railway franchise.

Oroville, Cal.—H. T. Batchelder, Co. Clk., writes that A. E. Boynton, of Oroville, has secured a franchise for an electric railway in Butte County, bids for which were opened on Mar. 10.

San Francisco, Cal.—It is reported that the Petaluma & Santa Rosa Ry. Co. (H. A. Klengel, Engr. Bebailopol) will extend its line from Green Valley to Forestville. An extension from Santa Rosa to Healdsburg is under consideration, the distance being 12 miles.

Miami, Fla.—B. B. Tatum has presented to City Council a petition for a franchise to build an electric railway in Miami.

Chicago, Ill.—It is reported that the Chicago & Oak Park Elevated R. R. Co. will construct a $500,000 power house.

Auburn, Ind.—The directors of the Angola Ry. & Power Co. have decided to improve the line, which extends from Angola to Lake James; also to extend the line from its present terminal at Angola to the Lake Shore depot.

Ft. Wayne, Ind.—The Toledo & Chicago Interurban Ry. Co. is stated to have received a franchise to extend the line from Waterloo to Ft. Wayne. The line is now built as far as Pioneer, O., and the purpose is to build to Goshen in the spring. Incorporators: F. H. Froehleek, John White and others.

Indianapolis, Ind.—The Indianapolis & Chicago Air Line Traction Co. is reported incorporated, with a capital of $1,000,000, to construct a line between Indianapolis and Chicago, via Jolietville, Kirklin, Michigantown, Flora, Idaville, Buffalo, Francesville, Crownpoint, Indian Harbor and numerous other intervening towns. G. B. King, of Indianapolis; C. J. Rauh, of Chalmers; J. W. Alderman, of Chicago, Ill., and others, are reported interested.

The Traction & Terminal Co. is stated to have had plans prepared for 2 freight houses, 2 crosstown lines and several extensions.

**Petersburg, Ind.*—The Aylmer Constr. Co., Majestic Bldg., Detroit, Mich., is reported to have secured the contract for constructing a bridge over the White River, in Washington Township, for the Louisville & West Baden Traction Co.

Grinnell, Ia.—The directors of the Grinnell Interurban Ry. Co. have elected O. K. Cole Pres. and E. B. Brande Secy. Work of getting options on the right of way will commence soon.

Lexington, Ky.—The Central Kentucky Traction Co. is reported incorporated with a capital of $200,000. This company will succeed to all the rights of the Fayette Interurban and the Blue Grass Consolidated Traction Cos., and will carry out in their entirety, so it is said, the plans of these companies. It will construct a line between Lexington and Versailles. Louis des Cognets is reported interested.

**Lake Charles, La.*—Contracts are reported to have been closed with the Westinghouse Co. for the equipment for the Lake Charles St. Ry. Co. with electricity.

Grand Rapids, Mich.—Surveys are reported to have been completed, rights of way secured and 2-3 of the capital subscribed for the Grand Rapids & Northern Ry., which is to be constructed between Grand Rapids and Rockford.

Minneapolis, Minn.—The Twin City Rapid Transit Co. (D. W. Dozier, Ch. Engr.) is reported to be having surveys made for the projected Excelsior extension, and will build it by the shortest route.

Gulfport, Miss.—The West Gulfport & Race Track St. Ry. Co. is reported to have been incorporated by Phil. A. Dolan, J. R. Hill and others, with a capital of $25,000.

It is reported that the question of constructing an electric railway connecting Gulfport with Biloxi is under consideration. Capt. J. T. Jones, of Gulfport, and Walter White, of Biloxi, are reported interested.

Missoula, Mont.—An ordinance is stated to have been passed by the Council, granting a franchise to J. R. Wharton, of Butte, in behalf of Senator W. A. Clark, for the construction of a street railway line in Missoula. The system will embrace about 30 miles of road, the intention being to extend the line up the Bitter Root Valley. Senator Clark has acquired the McCormick and the Bandmann ranches along the Missoula River, and he proposes to use these as a site for a dam and power plant for developing power for the system.

Kansas City, Mo.—It is reported that improvement plans of the Metropolitan St. Ry. Co. (Geo. Lawson, Ch. Engr.) for 1905 call for the expenditure of $1,000,000. The proposed improvement includes the reconstruction of the 12th St. cable line, reconstruction of the tracks of the Westport line from 15th St. to Westport Ave., the completion of the Swope Park line, the James St. Viaduct and the new line to the stock yards, the installation of a 7,500-h.p. turbine engine in the power house at 2d St. and Grand Ave., and the establishment of a car storage yard at 9th St. and Lister Ave., and at 48th and Holmes Sts.

Edgewater, N. J.—The Edgewater & Hudson View Constrt. & Traction Co. is stated to have applied to Council for a franchise to construct an electric railway on the River Road the full length of the borough.

Corning, N. Y.—The Corning & Painted Post St. Ry. Co., reported to have filed with the Secretary of State a certificate of extension of the company's line from Corning to Elmira.

**Lyons, N. Y.*—John M. and C. J. Buckley, 67 Harrison St., Worcester, Mass., are stated to have been awarded a contract to construct the power plant for the Rochester, Syracuse & Eastern Ry. Co. at a cost of $60,000. The structure is to be of brick and stone, 177x124 ft.

Oneonta, N. Y.—Chas. H. Tilton, Eng. of the Oneonta, Cooperstown & Richfield Springs Ry. is reported to be making surveys for, and taking options on, the right of way for an electric railway between Oneonta and Catskill.

Schenectady, N. Y.—As soon as necessary franchises can be obtained, the Schenectady Ry. Co. will begin works on its extension to Saratoga from Ballston Spa.

Waverly, N. Y.—Petitions are stated to have been filed by the Chemung Valley Traction Co. and the Waverly, Sayre & Athens Traction Co. to run cars through the streets of Waverly.

Bloomdale, O.—It is stated that S. P. Douglass, of Toledo, is promoting a road to be known as the North Baltimore, Bloomdale & Eastern Electric Ry. The road will be about 12 miles long, extending from Fostoria to North Baltimore, where connection will be made with the Toledo, Bowling Green & Southern Traction Co.

Coshocton, O.—It is stated that the Zanesville, Cambridge & Northern Traction Co. contemplates constructing its road through Coshocton. The town is surrounded by high hills, and it is stated that the construction of 2 tunnels and several bridges would be necessary to enter the town, adding about $225,000 to the cost of the road.

Cincinnati, O.—It is reported that the annual meeting of the Cincinnati, Newport & Covington Light & Traction Co. (Jas. R. Ledyard, Supt., Covington, Ky.), was held at Newark, N. J., recently. It was decided to expend $100,000 for betterments, improvements to the gas system, the purchase of ten new cars and certain track improvements.

Cincinnati Traction Co. (Thos. Elliott, Ch. Engr.) is reported to have decided to make a large number of improvements to the system. About $500,000 will be expended within the next few months. The improvements will include the installation of a second 1,200-kw. generator in the 8th St. generating station, a large number of track improvements and the addition of a number of new cars.

Galion, O.—The Columbus, Delaware & Marion Ry. Co. is reported to be considering the construction of an electric railway from Marion to Galion. John G. Webb, Pres., of Springfield.

Marion, O.—It is stated that the Columbus, Delaware & Marion Ry. Co. will construct a line between Prospect and Richwood.

Zanesville, O.—The Muskingum, Coshocton & Tuscarawas Electric Ry. Co., is reported incorporated by John J. Adams, of Zanesville; F. L. Mooney, of Woodsfield, and others, to build a line from Zanesville to New Philadelphia.

Lima, O.—The parties interested in the Lima Electric Ry. & Light Co., who propose to build an interurban line north from Lima, is stated to have secured practically all right of way from Lima to Leipsic, and have franchises in the majority of the towns. The line will probably extend to Toledo, but will be built only to Leipsic this year. Contracts for material and work are reported as being placed. J. A. Bendure, of Lima, is in charge of the work.

Salem, Ore.—The Cyrus Pierce Syndicate and Halsey & Co., of Philadelphia, are reported to have under consideration the construction of a network of electric railway to connect Southern Washington and Eastern Oregon with the coast. It is stated that they have purchased the plant of the Salem Electric Light Co. at Salem, and contemplate constructing a road up the Wilamette Valley to Portland. The same people purchased the Baker City electric and gas plant recently for $400,000. They own electric plants at Pendleton and Walla Walla, Wash., and are said to be negotiating for plants at Dayton, Wash., and Lewiston, Idaho, and propose connecting the cities mentioned with their new line.

Greencastle, Pa.—It is stated that agreements for rights of way between here and Chambersburg, secured several years ago by the Chambersburg, Greencastle & Waynesboro Ry. are being renewed, which indicates the early building of the line between Greencastle and Chambersburg.

Greensburg, Pa.—The Westmoreland Electric Ry. Co. is stated to have decided to extend lines from Beatty to Jamison, Crabtree, New Alexandria and Leechburg.

Hummelstown, Pa.—The Hummelstown & Campbelltown St. Ry. Co. is stated to have decided to issue bonds amounting to $225,000 to provide for an extension of the line into Campbelltown, and thence prospectively to Bismarck. M. S. Hershey, Pres.

Jeanette, Pa.—The contract for the electrical equipment for the proposed electric railway from Jeanette to West Newton, to be constructed by the Jeanette, West Newton & Monongahela Valley St. Ry. Co., is stated to have been awarded to the New England Eng. Co. The line will be 13 miles long, and will pass through the towns of Edna, Arona and New Madison.

Scranton, Pa.—Select Council is reported to have granted a franchise to the Scranton, Factoryville & Tunkhannock Ry. Co.

Sharpsville, Pa.—Council stated to have granted a franchise to the Greenville Traction Co.

St. Claire, Pa.—Town Council is reported to have passed the ordinance granting a franchise to the Tamaqua & Pottsville Electric Ry. Co. (D. J. Duncan, Supt., Pottsville), to build an extension through St. Clair to Trackville & Shenandoah.

A franchise is stated to have been granted to the Schuylkill Electric Ry. Co. to construct a line from Paterson and 2d Sts. to the western line of the town.

Sunbury, Pa.—The Northumberland County Traction Co. is stated to have decided to extend the Lewisburg, Milton, Watsontown line from East Lewisburg to Northumberland, via Montandon. At that point it will connect with the Sunbury and Northumberland road.

Tarentum, Pa.—The Borough Council is stated to have passed an ordinance granting right of way through the borough to the Tarentum & Brackenridge St. Ry. Co. The line will run from Tarentum to Brackenridge and will later be extended to Freeport.

Waynesboro, Pa.—It is reported that the projectors of the Hagerstown-Waynesboro Electric Ry. Co. will ask Town Council for a franchise to build a line on Church St., between 3d and the borough limits.

Roanoke, Va.—The Roanoke Ry. & Electric Co. is stated to have received a franchise for the extension of its lines into the Belmont section.

Fairmont, W. Va.—The Manington Light & Power Company, with a capital of $100,000, is reported incorporated to construct an electric railway between Fairmont and Manington. The incorporators are: W. H. Furbee, J. M. Barrack, and others, all of Manington.

Manitowoc, Wis.—The Fox River Ry. Co. has been incorporated by Henry W. Beyersdorf, L. N. Bazlen and Fred Beyersdorf, to construct an electric line in Manitowoc, Sheboygan and Outagamie Counties.

Rio de Janeiro, Brazil.—See "Power Plants, Gas and Electricity."

Santa Fe, N. M.—The Rio Grande Valley Electric Ry. Co. is reported to have been incorporated with a capital of $1,000,000, to build an electric railway 65 miles long from El Paso, Tex., to the mining camp of Organ, in Dona Ana County, via Las Cruces, Don Ana and Anthony. The office of the company is at Las Cruces.

Hamilton, Ont.—The Hamilton Cataract Power, Light & Traction Co. is stated to have decided to extend its lines to Oakville.

Milton, Ont.—It is stated that Jas. Waldbrook, of the Halton County Council, will probably build an electric railway from a point on the line of the Toronto & Hamilton Electric Ry., to run northerly through Milton, Georgetown and Acton.

Toronto, Ont.—The Toronto & Niagara Power Co. is reported to have under consideration the construction of an electric railway from Toronto to Niagara Falls.

RAILROADS.

Notes Arranged Alphabetically by States.

Pine Bluff, Ark.—The Pine Bluff & Southern R. R. Co. has been incorporated with a capital of $400,000 to construct a railroad from Pine Bluff to Star City, a distance of 30 miles. Incorporators: W. H. Langford, J. B. Johnson, R. G. Atkinson, and others.

Pensacola, Fla.—The Pensacola, Columbus & Western R. R. Co. has been organized, with W. S. Keyser, Pres., and J. E. Stillman, Treas. The company is also incorporated in Tennessee, Alabama and Florida.

East St. Louis, Ill.—The Wabash Southern Ry. Co., of East St. Louis, is reported incorporated with a capital of $10,000, to construct a railway from Zeigler, Ill., in a northerly and northeasterly direction to Shumway, Ill. Incorporators: C. S. Clarke, St. Louis, Mo., and W. S. Forman, L. O. Whitnel and H. L. Browning, East St. Louis.

The East St. Louis, Waterloo & Chester R. R. Co. has been incorporated by Chas. N. Chase and Tyron J. Woodward, of St. Louis; Jas. P. Slade and A. B. Garrett, of East St. Louis, and Edw. P. Schoening, of Columbia, Ill.; capital, $25,000.

Indianapolis, Ind.—The Indianapolis & Chicago Air Line is reported incorporated; capital, $100.000. Directors, John W. Aldermen, Wm. S. Taylor, Chas. J. Raub, and others.

Terre Haute, Ind.—The stockholders of the Vandalia R. R. Co. (F. T. Hatch, Ch. Engr., St. Louis, Mo.), are reported to have voted to authorize the issue of $14,373,000 bonds to be used for improvements ordered by the directors.

Duluth, Minn.—Press reports state that the Duluth, St. Cloud, Glencoe & Mankato R. R. Co. will shortly let contract for about 110 miles of railroad construction from Mankato to St. Cloud.

Kansas City, Mo.—The Chicago & Alton R. R. Co. (G. H. Kimball, Ch. Engr., Chicago, Ill.), is reported to be preparing for extensive changes in the lines through Missouri this year. A corps of surveyors has been at work between La. and Kansas City all winter. The company will probably build a double track from the Mississippi River to Kansas City, and possibly find a new entrance to the latter place.

Brooklyn, N. Y.—The Brooklyn Grade Crossing Comn. on Mar. 21 approved the final plans as prepared by Edwin C. Swezey, the engineering member of the Comn., and L. V. Morris, engineer of the Long Island R. R., for the removal of the tracks of the Long Island R. R. from grade on the entire line of the road, from Bay Ridge and from Manhattan Beach to Atlantic Ave. at East New York, and northerly to the boundary line between Kings and Queens Counties at Cooper Ave., a distance of a little over 10 miles; the estimated cost of the work is $5,955,342, of which $5,627,875 is for abolishing the grade crossings, and $327,966 for unopened streets. Half the expense will be borne by the city and half by the L. I. R. R. Co.

East Branch, N. Y.—An application has been made to the State R. R. Comn. by the Delaware & Eastern R. R. Co. for a franchise for a new steam road, from East Branch, N. Y., to Arksville, N. Y. This proposed new road will tap the Ontario & Western at East Branch, and connect with the Delaware & Ulster at Arksville. It will follow the easterly bank of the Delaware River; the road will porated for $600,000.

Toledo, O.—Local press reports sta Lake Shore R. R. Co. (F. J. Stout, C Cleveland), will expend about $500,0 provement to the freight terminals i

**Philadelphia, Pa.*—The John Shi Co. is reported to have secured t for the grading and masonry for 2 se the B. U. & J. F. Shanley Co., th Eng. & Constr. Co. and John McM contract for one section each on the Main Line & East Penn Division of delphia & Reading Ry. Co. The total be about $350,000.

Chattanooga, Tenn.—The Southern (C. H. Ackert, Gen. Mgr., Washingto is reported to be planning to buil tracks between Chattanooga and Stev

Johnson City, Tenn.—A charter granted to the Johnson City Bake Southern Ry. Co., with a capital of $ construct a railroad from Johnson Cit Unicoi County on into North Caroli E. Uptegrove is reported interested.

Granger, Tex.—The Missouri, K Texas Ry. Co. (J. W. Petherem, C Dallas), is reported to be considering tension of its line east from here to Hearne, Madisonville, and to Trinity nect with the Missouri, Kansas and Te line in East Texas.

Houston, Tex.—It is reported that ity & Brazos Valey R. R. (R. H. Ba Mgr., Austin) is to be extended fro to Houston; another line will be run mont from some point on the Houston

Casper, Wyo.—Surveys are about by the Chicago & Northwestern Ry. C. Carter, Ch. Engr., Chicago, Ill.) entire system of railroads to be built oming this year. The proposed line tend west from Casper to the Shosho vation, with branch lines to Thermop Lander. about 250 miles in length.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by S

Ft. Liscum, Alaska.—Bids are want 29 for furnishing and delivering at S Tacoma, building and plumbing materia for constructing a field officers' quarte double set non-commissioned officers' qu this post. Address F. G. Hodgson, Ch Vancouver Barracks, Wash.

Birmingham, Ala.—Bids will be recei 6 by the Bd. of Revenue for erecting a and barn on Poor Farm. John T. Re

**Hot Springs, Ark.*—Atkinson Br Colorado Springs, Colo., it is reporte received the contract to erect the cou at about $115,000.

Wynne, Ark.—It is reported that tract to erect the Cross County cou will be let about April 30. Probab $40,000.

Sacramento, Cal.—A bill has passed sembly appropriating $150,000 for th ment of a sanatorium for the treat curable cases of tuberculosis.

San Francisco, Cal.—Henry H. Me Clarence R. Ward, 532 Market St stated, have prepared plans for a th brick and stone Hahnemann Hospita is to be erected at California and Ma at a cost of $120,000. W. W. Van is Chmn. Bldg. Com.

**Savannah, Ga.*—The Liddell Htg. & Co., of Montgomery, Ala., has secured tract for installing a ventilating and low steam heating apparatus in the U. S. Hospital at Savannah (bids opened Ma $4,499.

Washington, D. C.—Percy Ash, Prof. itecture, writes that the date of receiv petitive plans for the group of building George Washington Univ., at Van Ness been extended from Mar. 15 to May cording to reports there are to be 13 bu the group, including an administration cost $500,000; an alumni hall, $150,000; law, politics and diplomacy, $150,000; a class rooms and professors' offices, to b as Corcoran Hall, $125,000; a hall for t of architecture, $60,000; 8 dormitories, arate or in block, $150,000. The costs approximate, but are to include every paintings and furniture.

Washington, D. C.—Local press rep that the following are the bids opened 8 by Elliott Woods, Supt. U. S. Capi and Grounds, for the cut-stone work f terior facades and court walls for the of ing of the House of Representatives— sum based on the use of limestone on th and limestone with granite base on t *b*, lump sum, based on marble instead stone on the facades; *c*, for street faca based on limestone; *d*, based on granite on marble; *f*, for the court alone based stone and granite: Vermont Marble C Rutland, Vt., *e*, $891,000. New Engla ite Wks., Concord, N. H., *d*, $979,00 Kerber Cut Stone Co., Bedford, Ind., *a* $759,387 and $761,387; *b*, $553,312; *f*, B. A. & G. N. Williams, New York. (2 bids), $981,000 and $1,032,000. T Starrett Co., New York, N. Y., *d*, $ Wm. Bradley & Son, New York, N. Y., 008; *b* (2 bids), $1,099,249 and $1,121, on granite entirely; *c*, $557,759; *d* $875,000 and $987,500; *f*, $224,229. A. nard, New York, N. Y., *a*, $644,000; b 000, based on granite entirely; *c*, $5 $963,000; *f*, $203,000. Thos. Reilly, phia, Pa., *a*, $712.253; *c* (2 bids), $50 $512,600; *d* (3 bids), $1,097,700, $1,09 $1,077,999; *e* (2 bids), $1,039,600 and

**Items marked thus give the names of parties awarded contracts.*

ids), $206,100 and $208,400. Furst Chicago, Ill., *a*, $829,772; *e*, about ooth Bros. & Hurricane Isle Granite ork, N. Y., *d* (2 bids), $881,000 and Geo. Dugan, Bedford, Ind., *a* (2 105 and $839,065; *c*, $586,385; *f*, Woodbury Granite Co., Woodbury, ds), $888,640, $1,078,000 and $1,115,- aryland Granite Co., Baltimore, Md., granite entirely, $311,000.

be received by Bernard R. Green, onstr. office of Bldg. for National ibrary of Congress, on Apr. 11, for and delivering at the new building tional Museum white brick for court as advertised in The Engineering

Ill.—Bids are wanted Mar. 28 for material and erecting 4 fire-escapes ; bids are also wanted on same date ing material and erecting fire-engine lybourn Ave.; bids on carpenter, ma- te, iron work, sheet metal work, and o be submitted separately. F. W. mr. Pub. Wks.

olis, Ind.—The members of the Meth- ch, it is reported, are contemplating n of a hospital to cost $200,000. The ilding is to be erected first, the cost lding to be about $80,000.

e, Ind.—It is reported that the Trus. te Soldiers' Home have approved plans idows' Home, and wil receive bids for n. $50,000 has been appropriated by ature for this building, to include the s. It is also reported that the Trus. receive bids for enlarging the heating which $36,000 has been appropriated. nock, Commander.

le, Ind.—Reports state that the Bap- and Industrial School will be erected at an estimated cost of $33,000, and for its construction will be asked as plans have been prepared. A. A. f Indianapolis, is a member of the Bd.

Bluffs, Ia.—The Trus. of the Chris- ie, an institution maintained by private for the care of homeless children, ted, will soon commence the erection lditonal building to be known as the lemorial, in honor of the founder, Rev. men. Something over $15,000 has al- en donated toward this building.

Moines, Ia.—Additional contracts in n with work at the Court House have rded, according to reports, as follows: work to the Holbrook Mantel & Tile Des Moines, at $56,830; scagiola work, to ry Marble Co., of Chicago, Ill., at and mosaic flooring to the Casini Mo- Tile Co., Cincinnati, O., at $22,233.

ood, Ia.—Bids will be received until y the State Bd. of Control of Institu- Des Moines, for erecting several build- he Glenwood Insti., to cost in all about and to include new boiler house, en- se, refrigerating plant, smokestack, coal d 1,200 ft. of 6½ ft. tunnel.

osa, Ia.—S. R. Crissy, City Clk., writes date of opening of bids for erecting all and fire department building have ended from Mar. 13 to Apr. 3.

ue, Ia.—The Sisters of the Good Shep- said to be contemplating the erection w building to cost about $75,000.

port, Ia.—The following are reported e bids received by the Bd. of Control Moines on Mar. 18 for erecting new at the Soldiers' Orphans' Home here: Reimer & Co., Marshalltown, $21,261; White, Eldora, $22,480; C. E. Heaps, land, Ill., $19,492; H. Eilenberger & cago, Ill., $18,771 (awarded contract).

w, Ky.—It is stated that bids will be until Mar. 31 for erecting a jail and esidence. G. M. Bohannon. Comr.

ort, Ky.—Henry B. Ware, Secy. State Com. writes that bids will probably asked for the erection of the State Cap- bable cost of construction, $1,000,000.

ore, Md.—Wyatt & Nolting, 4 E. Lex- St., it is stated, have secured the con- competition for the plans for the group ings to be erected on Cedar Ave. for nton Female Orphan Asylum. The t of the buildings, including landscape g, is to be about $50,000.

oro, Mass.—Dr. E. B. Harvey, C. S. nd Melvin H. Walker have been ap- as a committee to select an architect e plans prepared for a library to cost 0,000.

r, Mass.—At the town meeting, held 1, the citizens voted in favor of erect- 25,000 firehouse in W. Gardner.

, Mich.—The erection of a fire station ilwaukee Ave. mfg. district, is reported onsideration. Probable cost, $24,000.

, Mich.—All bids opened on Mar. 2 by erv. Archt., Treas. Dept., Washington, for erecting the U. S. Post Office at have been rejected. The lowest bid re- nounted to $45,392.

apolis, Minn.—A bill has passed the uthorizing this city to issue $250,000 r the completion of the court house and

a, Minn.—Bids are wanted Apr. 5 for ion of a county poor building, probable ,000. J. Winzewski, Co. Aud.

Wing, Minn.—The City Council and of Fire Comrs., it is stated, have de- erect a building at a cost of $25,000. sed as a central fire station, city hall lock-up.

Columbia, Miss.—It is reported that bids will be received Apr. 10 by the Bd. Co. Supervs. for erecting a court house.

Booneville, Miss.—It is reported that the citizens on March 9 defeated the question of issuing $25,000 bonds to provide funds for further work on the court house and jail.

**Louisiana, Mo.*—F. W. Menke Stone & Lime Co., of Quincy, Ill., have secured the contract for erecting complete the U. S. Post Office at Louisiana (bids opened Feb. 28), for $29,483.

Jefferson City, Mo.—A bill has passed the House appropriating $150,000 for the establishment of a State Reformatory and industrial school for male persons between the ages of 18 and 30; a bill has also passed the Senate appropriating $50,000 for the erection of a building to be used as a sanitarium for consumptives.

Moberly, Mo.—The following are the bids opened on Mar. 14 by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction, including plumbing, heating, electric wiring and conduits, U. S. Post Office at Moberly: Garthwait Constr. Co., Chicago, Ill., $27,000; J. D. FitzGibbons, St. Louis, $33,941; Courtney Bros., Hannibal, $34,823; Dieter & Wenzel, Joplin, $31,764; Paducah Constr. Co., Paducah, Ky., $31,992; F. W. Menke Stone & Lime Co., Quincy, Ill., $31,652; J. A. Daly, Nevada, $30,642; English Bros., Champaign, Ill., $31,697; M. Yerger & Son, Danville, Ill., $31,837; Latimer & Bennings, Kansas City, $31,249; Stevenson & Getaz, Knoxville, $30,760, and Moon Constr. Co., Topeka, Kan., $30,825.

**Hastings, Neb.*—The Allen-Black Co., of St. Paul, has secured the contract for the heating apparatus for the U. S. Post Office (bids opened Mar. 1), for $4,351.

Seward, Neb.—It is reported that bids are wanted Apr. 10 for erecting a court house. Geo. A. Berlinghof, Archt., Beatrice. Address J. M. Calder, Clk.

Concord, N. H.—Wm. M. Butterfield, of Manchester, is architect for new buildings to be erected at the State Hospital located in Concord. Plans and estimates will probably be ready about April 1.

Camden, N. J.—Local press reports state that the following are the bids received on Mar. 15 by the Camden Co. Bldg. Com. for the jail equipment of the new County Court House, including cells, gratings, etc.: (*a*), for the reinstallment of the 72 cells now in use and 20 new ones; (*b*), for their installment of the old cells and 40 additional new ones; (*c*), for a complete outfit of 130 new cells. E. F. Smith Fire Proof Constr. Co., Washington, D. C.: (*a*), $24,489; (*b*), $31,954; (*c*), $41,410. Henderson & Co., Philadelphia, Pa.: (*a*), $27,237; (*b*), $42,467; (*c*), $50,857. Diebold Safe & Lock Co., Canton, O.: (*a*), $29,797; (*b*), $37,116; (*c*), $59,392. Van Dorn Iron Works Co., Cleveland, O.: (*a*), $21,235; (*b*), $28,5537; (*c*), $48,678. Whitehead Kales Iron Wks., Detroit, Mich.: (*a*), $27,895; (*b*), $36,886; (*c*), $54,074. Pauly Jail Bldg. Co., St. Louis, Mo.: (*a*), $26,370; (*b*), $36,573; (*c*), $53,485.

Trenton, N. J.—A building permit has been issued for the erection of an addition to the St. Francis Hospital, which is to cost about $80,000.

Overbrook, N. J.—The Senate has passed a bill authorizing the Essex County Freeholders at Newark to issue bonds for the completion of the Hospital for the Insane here.

New York, N. Y.—Bids will be received Mar. 28 by Nicholas J. Hayes, Fire Comr., for furnishing material and erecting a building on Liberty St. for Engine Co. No. 6, Boro. Manhattan.

West Point, N. Y.—Bids will be received by the Quartermaster, U. S. A., on Apr. 20 for the construction of 2 double and 4 triple sets of officers' quarters and the erection of cadet barracks, as advertised in The Engineering Record.

Sandy Hill, N. Y.—The Bd. of Superv., it is reported, has rejected all bids recently received for erecting the Washington County Clerk's office here, the lowest submitted being from Riley & Acker, of Glens Falls, at $11,535. New bids are to be received.

Roslyn, L. I., N. Y.—The citizens have petitioned the North Hempstead Town Bd. to submit to a vote the question of issuing $20,000 bonds for the erection of a town hall either at Roslyn or Mineola.

Long Island City, L. I., N. Y.—An ordinance was signed by the Mayor on Mar. 15 providing for an issue of Corporate Stock in the sum of $20,000 to provide means for the preparation of the preliminary plans and specifications in connection with the construction of County and Borough Buildings in the Boro of Queens.

Brooklyn, N. Y.—Bids will be received Apr. 4 (readvertisement) by John McG. Woodbury, Comr. St. Cleaning, N. Y. City, for furnishing material and erecting a stable on Flushing Ave., Graham and Little Nassau Sts.; also separate bids for installing ventilating and heating apparatus, plumbing and gas-fitting in said stable.

New York, N. Y.—The Bd. of Estimate has granted to Dr. John W. Brannan, Pres. Bd. Trus. of the Bellevue and Allied Hospitals, $850,000 for the equipment and extension of the hospital building.

Central Islip, N. Y.—The following are the bids opened on Mar. 8 by the State Comn. in Lunacy, Albany, for a dining-room building and employees' building at the Manhattan State Hospital at Central Islip:

Construction complete—P. Keeler Bldg. Co., Albany, $39,400; John Dyer, Jr., Albany, $44,900; W. S. Velsor, Islip, $45,711; A. Pasquini, New York, $48,800; H. Probst, New York, $49,900; J. V. Schaefer, Jr., & Co., New York, $52,742; Danl. J. Ryan, Brooklyn, $53,300; Richd. E. Henningham, Brooklyn, $53,553; Robt. J. Mahoney, New York, $55,825; P. J. McCaffery, Utica, $56,290; L. E. Brown, Brooklyn, $56,939; Loper Bros., Port Jefferson, $58,377.

a, Heating; *b*, plumbing—John L. FitzGerald, Albany, *a*, $2,262; *b*, $4,400. Gaylord & Ettapenc, Binghamton, *a*, $2,473. Breen Bros., Utica, *a*, $2,535; *b*, $5,436. Chas. C. Sanborn, Boston, Mass., *a*, $2,998. Cleghorn Co., Boston, Mass., *a*, $3,000. United Htg. Co., New York, *a*, $3,232. E. Rutzler Co., New York, *a*, $3,248. R. T. Ford, Rochester, *a* $3,300; *b*, $4,200. Edw. P. Bates, Albany, *a*, $3,319. J. J. Horan & Co., Troy, *a*, $3,407. John B. Field, Islip, *a*, $3,825; *b*, $5,559. Edw. Joy, Syracuse, *a*, $3,997; *b*, $4,854. Howe & Bassett, Rochester, *b*, $5,000.

Electric light wiring and fixtures—Commercial Constr. Co., New York, $2,235; Edw. Joy, Syracuse, $3,832.

Raleigh, N. C.—The State Legislature has authorized the erection of a new building at the Hospital for the Insane in this city, to be for female patients, the cost to be about $40,000.

Elizabeth City, N. C.—The following are the bids opened on Mar. 20 by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction of the U. S. Post Office and Court House at Elizabeth City: Penn Bridge Co., Beaver Falls, Pa., $87,480; Banks & Jones, Norfolk, Va., $108,018; The Mankin Constr. Co., Richmond, Va., $87,277; R. T. Wardrup, Knoxville, Tenn., $97,200; H. R. Richardson & Son, Hampton, Va., $89,757; Athens Constr. Co., Athens, Ga., $83,000; Cramp & Co., Philadelphia, Pa., $86,159; Miles & Bradt, Atlanta, Ga., $91,364; E. Tatterson, Norfolk, Va., $89,995; King Lumber Co., Charlottesville, Va., $111,376; E. Hart, Norfolk, Va., $99,867; W. E. Spier, Washington, D. C., $85,600; Savannah Constr. Co., Savannah, Ga., $101,753; General Supply & Constr. Co., New York, N. Y., $83,490; Richardson & Burgess, Washington, D. C., $94,990, and Dean & Hasen, Olean, N. Y., $107,012.

Jamestown, N. D.—It is reported that bids will be received in April for the completing of two buildings at the State Insane Asylum, the cost to be about $54,000.

Cincinnati, O.—Bids will be received until Apr. 18 (extension of date) by the Bd. Trus. of the Pub. Library for the erection of the Carnegie Branch Library at Vine and Daniels Sts., known as Corryville Carnegie Branch Library. Wm. A. Hopkins, Clk.

**Findlay, O.*—The Hamilton-Irvin Co., of Fairmont, W. Va., has secured the contract for erecting U. S. Post Office, complete, for $35,642 (bids opened Mar. 7).

**Dayton, O.*—It is reported that the contract to construct the concrete and steel grand stand at the county fair grounds has been awarded to E. M. Gephart, 1902 W. National Ave., at $18,445.

Tillamook, Ore.—It is reported that bids will be received until Apr. 10 by the County Court, for furnishing material and erecting a brick or artificial stone court house. C. B. Lamb, Co. Clk.; Chas. Burggraf, Archt., Albany, Ore.

Carrick, Pa.—Bids will be received Mar. 27 by R. T. Rossell, Boro. Secy., for erecting a town hall on Brownsville Road. Edw. Stotz, Archt., Monongahela Bank Bldg., Pittsburg.

Hollidaysburg, Pa.—It is reported that bids are wanted Apr. 3 for addition and alteration to court house. W. S. Hostler, Clk. Co. Comrs.

Pittsburg, Pa.—Jail extension bonds amounting to $600,000 have been sold.

Retreat, Pa.—Press reports state that bids are wanted Apr. 6 for erecting an addition consisting of 3 new wings to Hospital for Insane; estimated cost, $160,000; bids have been asked from local contractors. McCormick & French, Archts., Laning Bldg., Wilkesbarre.

**Washington, Pa.*—Thos. Reilly, of Philadelphia, has secured the contract for constructing the U. S. Post Office at Washington (bids opened Jan. 25), for $47,763.

Rock Hill, S. C.—The City Council is said to be considering the erection of a new city hall.

Deadwood, S. D.—Competitive plans will be received until April 8 by E. H. Warren, Co., Aud., for a fireproof court house to cost about $75,000.

Memphis, Tenn.—The lady managers of the Woman's Hospital of Memphis, it is stated, have secured a site at Union and Middle Sts., and intend erecting a building to cost about $35,000.

Crossville, Tenn.—The Co. Court, it is stated, has accepted the plans of W. Chamberlin & Co., of Birmingham, Ala., for the court house which is to be erected to replace the structure which was recently destroyed by fire. It is to be constructed of limetone, and is to cost about $25,000.

Seattle, Wash.—A building permit has been issued for a five-story addition which T. S. Lippy will erect to the Seattle General Hospital, cost $36,000. It is reported that another similar addition is planned for the future.

Spokane, Wash.—Architect Williams is stated to have prepared plans for a new hospital for the Sisters of the Sacred Heart, to cost $35,000.

Medical Lake, Wash.—The Bd. of Control is about to select a site on which it is proposed erecting a detached wing at the Washington Insane Asylum here, for which $55,000 has been appropriated by the Legislature.

Appleton, Wis.—It is stated that a $50,000 Carnegie Library is to be erected here.

Darlington, Wis.—G. A. Marshall, Co. Surveyor, writes that Lafayette County is preparing to build, this summer, a court house, to cost $125,000, with money bequeathed by Matthew Murphy. The work will be done under direction of T. C. L. Mackay, Cashier of the First Natl. Bank, of Darlington, and a committee appointed by the Co. Bd. of Superv., of which G. F. West, of Darlington, is Chmn.

Douglas, Wyo.—Press reports state that bids will be received until Apr. 13 by the Co. Comrs. for erecting a court house, to cost about $25,000.

Santa Fe, N. M.—The Governor has signed a bill providing for a bond issue of $100,000 to increase the facilities of the New Mexico Asylum for the Insane.

**Toronto, Ont.*—Thos. McQueen, Secy. Bd. of Control, writes that contracts for the erection of a new Art Gallery at the Exhibition Grounds, Toronto, have been awarded as follows: Structural steel work—Hamilton Bridge Wks. Co., Ltd., Hamilton, $2,570. Excavation, brick, certain concrete and drain work and concrete floor and roof—Self Bros., Toronto, $18,950. Sheet metal work—Douglas Bros., Toronto, $7,298, and Plastering—Hanna & Nelson, Toronto, $2,428.

**Montreal, Que.*—John Quinlan, it is reported, has received the contract to erect the Alexandria Hospital, the total of which is to be about $240,000.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—The Warrant Warehouse Co. is about to be incorporated, with a capital of $200,000, for the purpose of erecting a system of warehouses for the storage of cotton. W. D. Nesbitt is said to be temporary Pres. of the Company.

**Montgomery, Ala.*—Nicholas Ittner, of Atlanta, Ga., it is reported, has received the contract to erect a $400,000 hotel here for The Jas. E. Hickey Hotel Co.

Palo Alto, Cal.—The Masonic Hall Assoc., is said to be contemplating the erection of a temple at University Ave. and Florence St., to cost $50,000.

Hartford, Conn.—The Odd Fellows, it is reported, are considering the erection of a lodge and store building on Church St., to cost about $100,000.

Wm. C. Daly, owner of the Hotel Hartford, it is reported, is contemplating the erection of an addition to the hotel, which will probably cost $100,000. John J. Dwyer, Archt., 78 Turnbull St., may be able to give further information.

Washington, D. C.—The P., B. & W. R. R. Co. has secured a permit to erect 2 warehouses on Virginia St., at a total cost of $90,000.

Jacksonville, Fla.—The erection of a Y. M. C. A. bldg. at a cost of $100,000 is reported under consideration.

Palmetto, Fla.—Jos. D. Burns, of Jacksonville, it is reported, is arranging to erect a $20,000 hotel here.

Titusville, Fla.—Wm. H. McFarland, it is reported, is interested in the erection of a hotel here to cost $30,000.

Chicago, Ill.—A. C. Frost, Pres. of the Chicago & Milwuakee Electric R.R. Co., 108 La Salle St., it is stated, will enlarge his amusement enterprise at Fort Sheridan, known as Fort Sheridan Park, by the addition of a $35,000 vaudeville theatre. Paul F. P. Miller, of Chicago, is said to be the archt.

Plans are being prepared by P. J. Weber, Fisher Bldg., for an addition to the Kaiserhof hotel at 260-264 Clark St. The addition will be a 12-story structure, 59x116 ft., of stone, brick and terra cotta. Estimated cost, $250,000.

The plans for a warehouse which is to be constructed on Jackson Boule. and Halsted St. have been prepared by H. W. Tomlinson, 17 Van Buren St. The building will be of fireproof construction, 8 stories high, 123x178 ft. Estimated cost, $300,000. F. W. McKinney, manager of the loan department of the Royal Trust Co., has the project in charge for Mrs. Altha E. Best.

H. L. Ottenheimer, 109 Randolph St., is the architect for 2 factory buildings to be built for the Shank Constr. Co. One of these buildings is for the occupancy of the Erwin Rice Meat Co., and will be built on La Salle St. It will be 3 stories high, 50x123 ft., of mill construction, and cost $30,000. The other structure is to be built on Twentieth Pl. and Wentworth Ave. It will also be a 3-story building, and cost $35,000.

Building permits for additions to Mandel Bros.' store, involving an expenditure of $500,000, were issued by Building Commissioner Williams Mar. 16. The firm intends to put up a 12-story addition at 115 Wabash Ave., 72 ft. x 151 ft. The firm also secured a permit to add 3 stories to the present structure at State and Madison Sts.

Sears, Roebuck & Co. have secured a permit for the construction of a printing house, to cost $140,000, which is to be erected at 447 Spaulding Ave.

Decatur, Ill.—Reports state that the Wabash R. R. Co. (Jos. Ramsey, Pres., St. Louis, Mo.), will build shops here to cost about $200,000, and a 50-stall round house.

Indianapolis, Ind.—A. Kiefer Drug Co. will rebuild a $100,000 fire-proof building. D. A. Bohlen & Son, Archts., Majestic Bldg.

Sullivan, Ind.—The Sullivan Opera House Co., it is reported, has been incorporated for the purpose of erecting an opera house at an estimated cost of $40,000. G. W. Leach, Pres.

Terre Haute, Ind.—It is stated that bids are wanted Mar. 30 for erecting a 4-story, 150-room hotel, 80x170 ft., for the Plana Hotel Co. Gault & Gault, Archts., Vincennes, Ind.

Muskogee, Ind. Ter.—Bids will be received until Mar. 31 by Frank C. Faust, Ch. Engr., Missouri, Oklahoma & Gulf Ry., Muskogee, for constructing certain depots, section houses and other buildings on the line of said railway.

**Items marked thus give the names of parties awarded contracts.*

**Clinton, Ia.*—Contracts in connection with the erection of the Cromwell Hotel, at 6th Ave. and 2d St., it is reported, have been awarded as follows: General contract to the Tri-City Constr. Co., of Davenport, fire proofing to the General Fire-Proofing Co., of Youngstown, O., and structural steel to the Clinton Bridge & Iron Wks., of Clinton. The total cost of the building, it is reported, is to be about $250,000. Geo. T. Baker, of Clinton, is the Gen. Mgr. of the hotel.

Davenport, Ia.—The Joe R. Lane Investment Co., it is stated, has been incorporated with a capital of $100,000, for the purpose of erecting an office building at 3d and Main Sts. D. R. Lane, Secy and Treas.

Wichita, Kan.—R. C. Gardner, of St. Louis, Mo., it is stated, has prepared plans for a branch warehouse, which the Simmons Hardware Co. intends erecting in this city at a cost of about $100,000.

Danville, Ky.—The Elks Lodgs is said to be contemplating the erection of an opera house here to cost $25,000.

Shreveport, La.—Gov. Blanchard, it is reported, has signed a contract with the Interstate Amusement Circuit Co., by which the Governor will remodel a building, owned by him, on Millen St., for use as a vaudeville theatre, the cost of the improvements to be about $20,000.

**Baltimore, Md.*—Broderick & Wind, of St. Louis, Mo., it is reported, have received the contract to erect the Keyser Office Bldg., a 10-story fireproof steel building, 109x82 ft., which is to be erected at Calvert and German Sts.

A building permit has been granted to W. L. Stork to erect a 7-story brick building at Charles and Franklin Sts., at a cost of $75,000.

Boston, Mass.—Plans have been filed with the Bldg. Comr. as follows: By Thos. J. Stearns, Supt. Roxbury Carpet Co., 37 Simmons St., for a 4-story building for light manufacturing, to be erected on Linden Park and Hampshire St., 59x86 ft.; Architect, Robt. A. Watson, 38 Hillside St., Roxbury; also a power plant, 62x84 ft., of brick and granite, and brick chimney, 200 ft. high; to be located on Baker's Court, Dorchester District. Builder, J. W. Bishop Co, 53 State St. Architects, Dean & Main, same address; owners, Walter Baker & Co.; also warehouse and 8 stores, for Chas. F. Morrill, 19 Highland Ave., Roxbury Dist. It will be 162x200 ft., 8 stories high; steel frame, brick and concrete, and will be located at 194-6-8 Rutherford Ave., Charlestown Dist.

Greenfield, Mass.—W. J. Howes, of Holyoke, it is reported, has prepared plans for a boys' clubhouse which it is proposed erecting at a cost of about $18,000. Rev. E. H. Sherwin may be able to give further information.

**Springfield, Mass.*—H. P. Cummings & Co., of Ware, it is stated, have received the contract to erect an addition to the Worthy Hotel at about $55,000.

Worcester, Mass.—The Crompton Blk., a 5-story building, it is reported, has been destroyed by fire.

Detroit, Mich.—Dr. Martin Campbell, it is stated, is interested in the erection of a brick and steel vaudeville theatre at 225 Randolph St.

Detroit, Mich.—The Knights of Pythias, it is stated, are contemplating the erection of a building for lodge rooms, library, gymnasium and general club quarters, the cost to be about $200,000.

St. Paul, Minn.—Geo. Somers & Co., will erect a 7-story brick building on E. 6th St., bet. Waconta and Rosabel Sts., to cost $200,000.

Geo. Benz will erect a 2-story brick building on 7th St., bet. Rosabel St. and B'way for stores, to cost $25,000.

One story additional will be erected on top of 4-story brick building on 7th St., bet. Cedar and Minnesota Sts. A. McQuillan, Agt., cost $35,000.

Wm. and Henry Endicott, of Boston, Mass., it is stated, are having plans prepared for a brick store and office building which they intend erecting at 6th and Cedar Sts., at a cost of about $150,000.

F. A. Maron, it is reported, will erect this spring a 4-story brick hotel at 6th, 7th and Washington Sts., at a cost of about $60,000.

Greenville, Miss.—Lodge No. 148, B. P. O. E., it is stated, is contemplating the erection of a building, to cost about $20,000.

West Point, Miss.—H. S. Dodenhoff, Secy. Bd. of Trade, writes that there is a movement on foot to build an opera house, and Secret Order Hall combined. Information is desired from architects and builders as to plans, specifications and material for the complete job. Building estimated to cost from $60,000 to $75,000. H. S. Dodenhoff may be addressed.

Brookfield, Mo.—Dr. DeGraw, is said to be interested in the erection of a $25,000 theater in this city.

St. Louis, Mo.—H. G. Clymer, Chestnut and 7th Sts., it is stated, has prepared plans for a 2-story store and flat which is to be erected at Maple Ave. by the American Brewery Co. at a cost of $25,000; also plans for a 3 story addition to the building of the Benderscheid Mfg. Co. at 9th St. and St. Louis Ave., cost $20,000; also plans for a 4-story building to be erected at 6th and Carr Sts., for Chas. F. Bergesch; cost $25,000.

**Newport, N. H.*—Geo. H. Cutting & Co., of Worcester, Mass., it is reported, have received the contract to erect a 4-story 180x100 ft. addition to the plant of the Dexter, Richards & Sons Woolen Mill Co., the cost to be about $80,000. Edw. A. Buss, of Boston, Mass., is the archt.

Goshen, N. Y.—Plans have been submitted for the new buildings and improvements to the Grant Hugh Brown estate on Main St., the cost to be about $50,000. W. W. Ward, 18 W. 31st St., N. Y. City, is said to be the archt.

Raleigh, N. C.—A charter has been granted to the Elks Home Constr. Co. for the purpose of erecting a 3-story building for lodge and club rooms for the Elk Lodge, the cost, including furnishings, to be about $25,000. C. W. Barrett, of Raleigh, is the archt. L. A. Mahler is Chmn. Bldg. Com.

Cleveland, O.—See "Sewerage and Sewage Disposal."

Cleveland, O.—Watterson & Schneider, New England Bldg., it is reported, have prepared plans for alterations to the Broadway Savings & Trust Co.'s Bldg., at Broadway and Wilson Ave., the cost to be $35,000.

East Liverpool, O.—Plans are being prepared for a 5-story fireproof store building for Frank Crook, with a frontage of 47 ft., to cost about $50,000.

Plans are being prepared for a 5-story brick and fireproof department store building for W. L. Thompson, to cost $50,000.

Coshocton, O.—The Realty Co., it is reported, will erect a $20,000 building. R. Z. Dawson, Jr., of Columbus, is said to be the archt.

Springfield, O.—It is reported that the lowest bid received for erecting a new building at the Ohio Odd Fellows' Home was $65,000, and was considered too high. All bids have been rejected.

Altoona, Pa.—The Central Pennsylvania Trust Co., it is stated, has completed plans for a 5-story office building to be erected at 1218 11th Ave.

Harrisburg, Pa.—Howard Lloyd, 216 Market St., is preparing plans for a 6-story fireproof building which is to be erected on Market and 3d Sts. by Rothert & Co.

Homestead, Pa.—B. J. Stenger, it is stated, will erect at West St. and 8th Ave. a 7-story store and apartment building, to cost about $100,000.

McKeesport, Pa.—John Harris, of Pittsburg, it is reported, has had plans prepared for a $50,000 theater, which he intends erecting in this city.

**Nicetown, Pa.*—The Midvale Steel Co., of Philadelphia, it is reported, has awarded the contract to erect a shop at Nicetown to Geo. C. Dietrich. The building is to be known as Ordinance Building No. 4, and is to be used in connection with the manufacture of armor plate for the Government. It is to be of brick and structural steel, equipped with 2 large electric cranes, and is to be 165x550 ft., and to cost about $225,000.

**Philadelphia, Pa.*—Roydhouse, Arey & Co., Fidelity Bldg., it is stated, have received the contract to erect a 4-story addition to the plant of J. R. Keim & Co., at a cost of about $36,000.

*A building permit has been granted to Wm. Steele & Sons, 1600 Arch St., for a 5-story addition to the Orinoka Mills at Jasper and Somerset Sts. at a cost of $80,000.

*A. Raymond Raff, 1635 Thompson St., it is stated, has received the contract to erect the German Theater at Franklin St. and Girard Ave., at a cost of about $150,000.

**Pittsburg, Pa.*—John Ehrlinger, 71 Van Braan St., it is stated, has received the contract to erect a 3-story brick store and apartment building at 1708 Forbes St., for Wm. Hubner, to cost $33,000.

Sioux Falls, S. D.—It is reported that the Masons (Geo. H. Perry, Secy.) are preparing to erect a building at a cost of about $40,000.

Knoxville, Tenn.—W. J. Oliver, of Knoxville, it is stated, has had plans prepared for a 10-story hotel which he intends erecting at a cost of about $300,000.

**Memphis, Tenn.*—The Sleden-Breck Constr. Co., of Chicago, Ill., it is reported, has received the contract to erect a 3-story office building on Madison St. for the Trus. of the Wood estate, the cost to be about $30,000. Chighizola & Hanker, Scimitar Bldg., are the archts.

**Nashville, Tenn.*—The E. & N. Manufacturing Co., of Nashville, it is reported, has received the contract to erect the superstructure of the Methodist Publishing House, at Broad St. and 9th Ave. The total cost of the building is to be about $150,000.

**Galveston, Tex.*—Harry Devlin, 30th St. & Ave. H., it is reported, has received the contract to erect the building for the Fleming Dry Goods Co., at about $45,000. The contracts for the plumbing, heating, electric wiring and elevators are to be let separately.

**Cleburne, Tex.*—It is reported that John Bardon, of Ft. Worth, has received the contract to reconstruct the shops of the Santa Fe R. R. at Cleburne, which were recently destroyed by fire. The work consists of the construction of a 1-story brick building, 180x340 ft., which is to be occupied by the coach, paint and woodworking depts., also the erection of a 1-story fireproof brick, 20x40 ft., paint stock house. The total cost is reported to be about $65,000.

Dallas, Tex.—The Directors of the Praetorians, it is stated, have adopted plans prepared by the Keyser-Mozier Co., Juniata Bldg., for a 7-story fireproof building which is to be erected at Main and Stone Sts., probable cost $85,000. C. B. Gardner, Pres.

Ft. Worth, Tex.—It is reported that L. G. Gilbert will erect a $20,000 building on Main St.

Hillsboro, Tex.—It is reported that W. I. Beckham, of Greenville, is preparing to erect a $35,000 hotel here.

Houston, Tex.—Dr. P. S. Griffith, of Houston Heights, is said to be interested in the erection of a hotel here to cost $300,000.

Wheeling, W. Va.—The directors of the Wheeling & Elm Grove RR. Co. (W. S. Wright, Engr., 16th St.), it is stated, are considering the erection of a casino in Wheeling Park, to cost $25,000.

Milwaukee, Wis.—It is reported that a warehouse for the handling of paper for manufacturing and other purposes is to be built in this city, and E. A. Bouer, general sales agent for a number of paper manufacturers in Wisconsin, is interested in the project. Probable cost, $25,000.

Schomberg Bros., it is stated, have taken out a permit to erect a 4-story store and apartment building at 4th and Sycamore Sts., to cost about $25,000.

Toronto, Ont.—The erection of a Master Builders' Exchange in this city is reported under consideration. J. R. Hoide is interested.

Toronto, Ont.—The Traders' Bank of Canada, it is reported, have had plans prepared for a 15-story bank and office building, which they intend erecting at Yonge and Colborne Sts.

New York, N. Y.

Franklin and Greenwich Sts, 5-story br and stone store and office bldg; c, $32,500; o, Chas J Degerhardt; a, Jos Wolf.

98 Ave C, 6-story br and stone store and tenemt; c, $48,000; o, A Danziger; a, Geo F Pelham.

44 Ave D, 6-story br and stone store and tenemt; c, $52,000; o, Adolph Danziger; a, Geo F Pelham.

Bowery and Prince St, 6-story br and stone store and tenemt; c, $45,000; o, Chas J Weinstein; a, Geo F Pelham.

67th St and 1st Ave, 2 6-story br and stone stores and tenemts; c, $40,000; o, Geo L Banzer; a, Edwin C George.

105th St and Park Ave, 6-story br and stone store and tenemt; c, $84,000; o, Schlesinger & Fenichel; a, Ed A Meyers.

111 E 112th St, 6-story br and stone store and tenemt; c, $42,000; o, Abraham Perelman; a, Geo F Pelham.

321 E 121st St, 6-story br and stone stores and tenemts; c, $50,000; o, Wm Soltz; a, Horenburger & Straub.

133d St and Amsterdam Ave, 2 6-story br and stone stores and tenemts; total c, $100,000; o, Brody, Adler & Koch; a, Sass & Smallheiser.

Bway and 139th St, 6-story br and stone stores and tenemt; c, $175,000; o, Geo L Walker Co; a, Geo F Pelham.

159th St and Elton Ave, 2-story club house; c, $40,000; o, Jefferson Constr Co; a, M J Garvin.

Hoe Ave and Home St, 2 5-story br stores and tenemts; total c, $56,000; o, Eastern Crown Realty Co; a, Rudolph Werner.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Washington, D. C.—A building permit has been granted to W. Duncan McKim to erect a 4-story brick dwelling at 1701 R. St., n. w.; cost $55,000.

Chicago, Ill.—L. M. Mitchell, 145 La Salle St., has prepared plans for 2 apartment buildings, of which one is to be erected at Sheridan Road and Wilton Ave., and the other at Evanston Ave. and Edgecomb Court. J. C. Cockburn, owner. Each building will be 3 stories high, and the total cost of construction will be $115,000. The same architect has made plans for a 3-story apartment to be built on Michigan Boule. and 56th St., 76x101 ft., to cost $80,000.

E. M. Newman, 108 La Salle St., has prepared plans for 2 apartment buildings, to be erected at Southport Ave. and Grace St. Each will be 3 stories high, 50x50 ft., and the total cost will be about $40,000.

N. W. Harris, the banker, will build a 3-story $100,000 residence at Lake Geneva. The plans have been prepared by Shepley, Rutan & Coolidge, Old Colony Bldg. It will have its own electric plant.

The First Baptist congregation of Berwyn has determined to erect early next summer a new stone church, 123x80 ft., for which G. W. Ashby prepared the plans; cost $30,000.

Jas. Gamble Rogers, Ashland, Blk., has prepared plans for a chapel for the Buena Park Memorial Presbyterian congregation. The building will be erected on Sheridan Road and Montrose Boulevard, built of brick and stone, and will cost about $20,000.

Decatur, Ill.—It is reported that plans have been completed for a new edifice which is to be erected by the Grace M. E. Church, at a cost of $35,000.

Kewanee, Ill.—It is reported that bids are wanted Mar. 30 for erecting an edifice for the First Baptist Church. Geo. C. Regna, Sec'y Bldg. Com.

Des Moines, Ia.—A building permit has been granted to the Trus. of the Unitarian Church, 1023 High St., to erect a new edifice to cost $30,000.

Evansville, Ind.—It is reported that the congregation of the Ingle St. M. E. Church is contemplating the erection of a new edifice on Franklin St. to cost $20,000.

Huntington, Ind.—The congregation of the First Christian Church (Rev. Cephas Shelburne, Pastor), it is stated, is contemplating the erection of a new edifice, at a cost of about $25,000.

Indianapolis, Ind.—John Stem, Claypool
has prepared plans for a $25,000 residen
D. M. Parry, to be erected on Golden Hil
Clarence Martindale, Indiana Trust Bldg
prepared plans for a residence for A
Sweeney, to be erected at 3032 N. Meridia
to cost $25,000.

**Plymouth, Ind.*—It is reported that the
of the Episcopal Church has awarded the
tract to erect the new edifice to Jacob Ne
Plymouth, at about $15,000.

Shelbyville, Ind.—Burton F. Swain, it
ported, is contemplating the erection of a
dence to cost $35,000.

**Centerville, Ia.*—Foster & Powers, of J
Ill., it is stated, have received the contra
erect the First Methodist Church at
$24,974.

Trenton, Ky.—It is reported that bids
received Apr. 15 by J. L. Long, Archt.,
kinsville, for erecting an edifice 45x50 f
press brick and Bedford stone for the Meth
Church.

Lewiston, Me.—The congregation of SS.
and Paul Church, it is stated, intends ere
a new edifice, to cost about $350,000.
Noel Coumont is the archt.

Boston, Mass.—A. C. Chisholm, 556 W
St., Roxbury, proposes erecting a group o
3-family dwellings, 3 stories high, on W
St., and in Chisholm Park, Roxbury Dist
timated cost $50,000.

**Hudson, Mass.*—Geo. H. Cutting & Co
Worcester, it is reported, have received the
tract to erect a dwelling for L. D. Apsley
the Apsley Rubber Co., which is to cost
$30,000. H. H. Atwood, of Boston, is
archt.

**New Bedford, Mass.*—Wm. E. Hatch,
and Chmn. Bldg. Com., writes that the co
for erecting an addition to New Bedford
tile School (bids opened Mar. 13) has
awarded to B. F. Smith Co., of New Bed
for $21,556.

Detroit, Mich.—The members of the
Woodward M. E. Church, it is reported
contemplating the erection of a new edif
cost about $60,000.

St. Paul, Minn.—A permit has been issu
Henry L. Lange for a 2-story brick veneere
building, to be erected on Gorman Ave.
George and Rabic Sts., to cost $35,000.
Emmanuel L. Masqueray, 156 5th Ave
Y. City, it is reported, has been engaged to
pare plans for the cathedral which is
erected at Dayton and Shelby Aves.

Winona, Minn.—E. A. Mahre is stated to
prepared plans for a school for the Polish
olic Church to cost $35,000.

**Yazoo City, Miss.*—The Southern C
Co. is reported to have secured the contra
erecting the Methodist Church here, for
565.

Kansas City, Mo.—Brick apartments w
erected in this city as follows: By Ralph B
at 113-21 W. Armour Boule., to cost $18,00
Anna H. Arnett, at 212-22 W. Armour B
to cost $18,000, and for Wm. J. Welsh, at
48 Bway., cost $15,000.

St. Louis, Mo.—The congregation o
B'nai El Temple, it is reported, has decid
issue $25,000 bonds for the purpose of erec
new temple next fall. Sigmund Sta
Chmn. Bldg. Com.

Brooklyn, N. Y.—It is stated that the
gregation of St. Barbara's Church is co
plating the erection of a new edifice at a
of about $100,000.

Raleigh, N. C.—It is reported that bids w
received Apr. 1 by John E. Ray, Chmn.
Com., for enlarging and repairing the
Baptist Church. C. W. Barrett, Archt., Ra

Sandusky, O.—H. A. Winters, it is rep
is having plans prepared for a flat which
tends erecting at Monroe and Lawrence S
a cost of $50,000.

**Toledo, O.*—E. H. Riffner, it is reporte
received the contract to erect a 3-story f
Ontario and Washington Sts. for Irving S
Probable cost, $30,000. Geo. S. Mills,
ner Bldg. is the archt.

Philadelphia, Pa.—It is reported that a
dicate, headed by A. H. Mershon, contem
erecting a $200,000 flat on 15th and Moun
non sts. The plans, by Milligan & Webbe
Walnut St., provide for a 4-story and bas
brick and stone structure, 200x120 ft.
Milligan & Webber, 520 Walnut St.,
stated, are preparing plans for a bachelor
ment house which is to be erected at Broa
Pine Sts., by Emil Kleinsmith. It is
5 stories high, of brick and limestone, a
cost about $35,000.

**Shamokin, Pa.*—Rev. John C. Konsta
ricz, of the Ruthenian Catholic Church
Transfiguration, writes that the contrac
erecting a church (bids opened Mar. 1
been awarded to Reit & Hilbush, cor.
and Franklin Sts. for $45,915.

Chattanooga, Tenn.—A building permi
been granted for the erection of a new
for the M. E. Church on McCallie Ave
Douglas St., at an approximate cost of $

Milwaukee, Wis.—Dohmen & Jacobi, of
waukee, it is stated, have prepared plans
new edifice which the congregation of the
gelical Friedens-Gemeinde Church intends
ing at a cost of about $25,000.

Racine, Wis.—Plans have been prepar
Guilbert & Rugh, for a 3-story brick and
flat which is to be erected at 7th St. and
lege Ave. by S. M. Hart, and is to cost
$25,000.

**Items marked thus give the names of parties awarded contracts.*

ton, Ont.—Bids will be received Mar.
. Wright, Sec'y Bd. Trus., for erecting
Iethodist Church with stone founda-
L. Wilson & Son, Archts., Chatham.

. *Ont.*—It is stated that bids are
ar. 29 for building the substructure of
:'s Church. A. W. Holmes, Archt.

NEW YORK, N. Y.

3d St, 6-story br and stone tenemt; c,
, Geo W Folsom; a, Chas C Haight.
t and Lexington Ave, 2 6-story br and
:mts; c, $110,000; o, Saml. T Slater;
Steckler.
: and 1st Ave, 2 6-story br and stone
:otal c, $70,000; o, M Romm; a, Bern-
Bernstein.
and 102d St, 2 6-story br and stone
; total c, $70,000; o, D. G. Tudins; a,
& Bernstein.
: and 101st St, 3 6-story br and stone
total c, $125,000; o, Nathan Navasky;
ein & Bernstein.
: and 100th St, 3 6-story br and stone
total c, $125,000; o, Rod, Greenberg &
a, Bernstein & Bernstein.
and West End Ave, 6-story br and
emt; c, $160,000; o, Saml Mandel; a,
Sloan.
113th St, 6-story br and stone tenemt;
); o & b, Wm J Taylor; a, Pollard &

St and Bway, 8-story br and stone
:, $175,000; o, Frank Woytisek; a, Ne-
agge.
e and 117th St, 2 6-story br and stone
total c, $70,000; o, Falk & Fine; a,
Sloan.
t and Amsterdam Ave, 6-story br and
emt; c, $70,000; o, West Side Constr
eo F Pelham.
St and 5th Ave, 2 6-story br and stone
total c, $70,000; o, Falk & Fine; a,
Sloan.
St and Amsterdam Ave, 5-story br and
emt; c, $40,000; o, Rosenthal & Levy;
r & Ebert.
St and Amsterdam Ave, 2 5-story br
e tenemts; total c, $76,000; o, Cohen,
Evans; a, Geo F Pelham.
St and 8th Ave, 6-story br and stone
c, $40,000; o, Saml. Mandel; a, Rouse

St and Forest Ave, 5-story br tenemt;
o; o, Anstey Constr Co; a, Moore &
el.
St and Jerome Ave, 3 5-story br tene-
il c, $175,000; o, John McGovern; a,
Landsiedel.
Ave and St Paul's Pl, 6-story br tene-
45,000; o, M Bernstein; a, Edwin Wil-

Ave and 156th St, 6-story br tenemt;
o; o, Jas Harris; a, Harry T Howell.
gton Ave and 174th St, 4 5-story br
total c, $160,000; o, Leader & Bloom;
burger & Straub.
e and St Paul's Pl, 5-story br tenemt;
oo; o, Reliance Constr Co; a, Geo F

SCHOOLS.

Arranged Alphabetically by States.

on, Ala.—The Bd. of Trus. of the Ala-
esbyterian College (Dr. John W. Stagg,
ingham, is Chmn.), it is stated, has
the plans of Breeding & Whilldin, of
am, for the new college building which
posed erecting here at a cost of about

Ariz.—It is stated that the citizens
ed in favor of erecting a school to cost
5,000.

ancisco, Cal.—See "Sewerage and Sew-
osal."

Francisco, Cal.—The School Bd. has
a resolution authorizing the Bd. of
cs. to submit plans and specifications
proposed Washington Grammer School.
d. of Trus. of the Mechanics' Institute
J. Taussig, Pres.), it is stated, is con-
the erection of a new building at Hayes
Sts.

ah, Ga.—The School Bd. has secured
nd intends erecting a school to cost

t, Ill.—Bids will be received until Apr.
Bd. of Educ. for erecting an addition
gh school, to cost about $35,000.

lle, Ill.—The following bids, it is re-
ave been received for erecting a pa-
chool for St. Valentine Parish. F. A.
$24,995; A. Utz, $26,809; Jos. Neu-
,250.

ngton, Ind.—It is stated that bids will
asked for erecting a law school and
t the Indiana Univ. for which pur-
Legislature recently appropriated $100,-
n. L. Bryan, Pres.

apolis, Ind.—John E. Clelland, Bus.
Educ., writes that the contract for erect-
ool on Rural St. (bids opened Mar. 14)
awarded to W. P. Jungclaus Co., of
lis, for $31,820.
W. P. Jungclaus Co., 827 Massachu-
., it is reported, has received the con-
erect a 10-room school on Rural St. at
Bids received Mar. 14.

te, Ind.—Reports state that the Trus.
efoy School of Home Cuture,' will soon
for erecting a building to cost about

Bend, Ind.—Calvin Moon, Supt. of
writes that the contract for erecting the
School, a 13-room building, has been
to A. B. Moon, 505 E. Washington St.,
oo (bids opened Mar. 9).

c, Ia.—Reports state that the citizens
ed in favor of issuing $25,000 school

Ia.—It is reported that the proposi-
sue $30,000 school bonds carried at the
held Mar. 10.

Iowa City, Ia.—Press reports state that bids will be received until Apr. 5 by the Executive Com. of the Bd. of Regents, for erecting an Engineering Building at the State Univ. of Iowa. Probable cost, $70,000. Proudfoot & Bird, of Des Moines, are the archts.

Covington, Ky.—Bids will be received Apr. 4 by the Bd. Educ. for ventilating and heating new 6th Dist. school. Schofield & Walker, Archts., Bank Bldg.; Jas. C. Metcalfe, Clk. Bldg. Com.

Louisville, Ky.—Bids will be received Mar. 30 by the Louisville School Bd. for heating Sylvia Ave. and Crescent Hill-Clifton Schools. Thomas & Bohn, Keller Bldg., and Hutchings & Hawes, Columbia Bldg., Archts., respectively. Chas. C. Martin, Secy.

New Orleans, La.—The Sisters of St. Joseph, it is stated, will erect a 4-story brick convent adjoining their institution facing Ursuline Ave.

Annapolis, Md.—Bids will be received Mar. 29 at the Navy Dept. (Chas. H. Darling, Asst. Secy.), Washington, D. C., for a terrace and fence wall at U. S. Naval Academy here. Ernest Flagg, Archt., 35 Wall St., N. Y. City.

Adrian, Mich.—Peter Dederichs, Chamber of Commerce Bldg., it is reported, has been engaged to prepare plans for a brick and stone chapel to be erected at the St. Joseph's Academy, at a cost of $30,000. It is reported that plans will be ready for contractors in about a month.

**St. Louis, Mo.*—It is reported that contracts have been awarded as follows for school work: Elleardville School, general contract to the E. C. Gerhard Bldg. Co., 620 Chestnut St., for $140,415; plumbing to the P. C. Ring Co., 3841 Finney Ave., $10,453, ventilating and heating to the B. F. Sturtevant Co., $16,450.

Franz Siegel School—General contract, to Fred Boeke Const. Co., $127,800; plumbing to Fink & Schuster Plumbing Co., 819 S. 4th St., $9,770; ventilating and heating, the B. F. Sturtevant Co., $16,400.

South St. Paul, Minn.—Chas. W. Clark, city sec'y, writes that the citizens voted on Mar. 14 to erect a school to cost about $25,000.

Minneapolis, Minn.—It is stated that the Bd. of Regents of the Univ. of Minnesota have selected a site on which it is proposed erecting the building for the institute of pathology and hygiene for which the Legislature has appropriated $105,000.

Salem, N. J.—It is stated that the Council is considering the erection of a high school at a cost of $30,000.

Brooklyn, N. Y.—Bids will be received Apr. 3 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for new iron stairways, alterations and repairs to schools Nos. 1, 8, 12 and 14.

Syracuse, N. Y.—Andrew Carnegie, it is stated, has given $150,000 to Syracuse Univ. to erect a library.

Bismarck, N. D.—The Bd. of Educ., it is stated, has decided to erect an 8-room brick school, to cost about $20,000.

Edgeley, N. D.—It is reported that bids are wanted Apr. 5 for erecting a school in Golden Glen Dist. B. A. Owen, Clk. Bd. Educ.

**Jamestown, N. D.*—John G. Bensch, Clk. Bd. Educ., writes that Hoagland Bros., of Hasty, Minn., have secured the contract for erecting a 3-story brick and stone high school (bids opened Mar. 11), for $25,000. The Fargo Plumbing Co., of Fargo, secured the contract for plumbing and heating same, for $4,166.

Lima, O.—Press reports state that bids will be received Mar. 30 by G. A. Herrott, Clk. Bd. Educ. for $15,000 school improvement bonds.

Oberlin, O.—C. P. Doolittle, Supt. Bldgs. and Grounds, Oberlin College, writes that it is proposed to erect a library. Architects, Patton & Miller, Chicago, Ill.

Kittanning, Pa.—It is reported that a high school is to be erected here a a cost of $25,000.

Pittsburg, Pa.—C. M. Bartberger, Westinghouse Bldg., it is stated, has prepared plans for a school to be erected in the 19th Ward, at a cost of $80,000. It is reported that bids for its erection will soon be asked.

Bids will be received Mar. 29 by the Bd. Dirs. Morse Sub-School Dist., 25th Ward, for $50,000 school bonds. John McKain, Secy., 1401 Carson St.

Philadelphia, Pa.—Bids wil be received by the Com. on Property at the office of Bd. Pub. Educ. for erecting a new 15-division school on 22d and Berks Sts., and for smokestacks and furnaces at Wharton School. A. F. Mammond, Secy.

Shamokin, Pa.—Bids will be received by the School Bd. on Apr. 3 for two 15-room schools.

Bristol, R. I.—It is stated that Col. Saml. P. Colt has offered this city $40,000 with which to erect a high school.

Kimberlin Heights, Tenn.—Barber & Klutz, of Knoxville, are preparing plans for the erection of a college here to take the place of one recently burned; probable cost, $30,000. Rev. Ashley Johnson, Kimberlin Heights, is interested.

Pulaski, Tenn.—The Martin College Bldg. Com., of which A. L. King is a member, has accepted plans for the new Martin College, as prepared by J. H. Yeaman, of Nashville. The building is to be a 3-story brick structure.

Port Arthur, Tex.—It is reported that bids are being received by the Com. for a 3-story 100x150 ft. industrial school, which is to be erected at a cost of $65,000.

Lynchburg, Va.—Dr. Wm. W. Smith, chancellor of the Randolph-Macon System of Colleges, it is stated, contemplates enlarging the Woman's College here at a cost of about $50,000.

Elm Grove, W. Va.—F. C. Kennedy, of Baltimore, Md., it is reported, has submitted to Bishop Donohue, of Wheeling, plans for a R. C. Industrial School, which, it is proposed erecting here at a cost of about $20,000.

**Delavan, Wis.*—The General Constr. Co., of Milwaukee, it is reported, has received the contract to erect the high school at about $60,000.

Dodgeville, Wis.—At a special meeting of the School Dist. on Mar. 10 it was voted to erect a new high school at a cost of $25,000.

New Richmond, Wis.—The high school, it is reported, has been destroyed by fire.

Madison, Wis.—J. T. W. Jennings, Univ. of Wis., it is stated, has prepared plans and specifications for a Farm Engineering and Implement Bldg., which is to be 3 stories high, 168x200 ft., and is to be erected at the Univ. at a cost of about $60,000.

Superior, Wis.—Carl Wirth, Bank of Commerce Bldg., is said to be preparing plans for a $25,000 school to be erected at Allouez.

St. Boniface, Man.—It is reported that an annex is to be erected to the St. Boniface College to cost about $50,000.

Walkerville, Ont.—Bids will be received Apr. 5 by F. H. Cooper, Secy. Pub. School Bd., for erecting a 15-room school. Albert Kahn, Archt., 1117 Union Trust Bldg., Detroit, Mich.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Waterbury, Conn.*—F. T. Reeves, Asst. City Clk., writes that the contract for the removal and disposal of garbage and offal for a period of 1 year (bids opened Mar. 9) has been awarded to P. H. Carroll, North Willow St., for $16,800.

Indianapolis, Ind.—Bids will be received Mar. 29 by the Bd. Pub. Wks. for sprinkling unimproved streets, alleys, avenues and public places. M. A. Downing, Chmn.

Regina, N. W. Ter.—Bids are wanted Apr. 10 for constructing a system of sewers. J. Kelso Hunter, Secy.-Treas.; John Galt, Ch. Engr., Toronto, Ont.

Columbus, O.—The City Council has passed an ordinance authorizing the Service Board to contract for 5 new street sweepers, 3 dumpers and 2 flushers; appropriation, $3,700.

NEW INDUSTRIAL PLANTS.

Notes Arranged Alphabetically by States.

The Kinnear Pressed Radiator Co., Bailey-Farrel Bldg., Pittsburg, Pa., which has a capital of $400,000, will erect a 90x600-ft. factory building of steel and brick at West Pittsburg. The plant will have a daily capacity of 8,000 to 16,000 ft. radiation.

The A. Beyer Electric Co., New Philadelphia, O., expects to add to its power equipment in the near future a 500-h.p. open feed-water heater, mechanical stokers under 500-h.p. of boilers, new rope transmission, shaft couplings, friction clutch pulleys, etc. No additional engines or boilers will be required.

The James Smith Woolen Machinery Co., 411 to 421 Race St., Philadelphia, Pa., expects to remove its plant to a new location, which will afford greater facilities. Details concerning the plant have not yet been decided.

The Hogg Lumber Co., Glen Jean, W. Va., expects to install two 20 or 25-h.p. mills at Greenbrier, W. Va., within the next 90 days.

The Great Western Heater Co., 226 Second St., Des Moines, Ia., is negotiating for the purchase of machinery for manufacturing the Phillips hot-water heater.

The Michigan Wire Cloth Co., Detroit, Mich., contemplates extending its plant, but details have not been decided.

The Hunter-Weckler Boat Co., McHenry, Ill., will erect a 2-story, 50x100-ft. brick building, and two 1-story, 50x100-ft. frame buildings at Eagle Point.

The Hewitt Rubber Co., Fidelity Trust Bldg., Buffalo, N. Y., will erect a plant which, when completed, will include a power-house 60 ft. square; two 60x200-ft. buildings, a 3-story, 100x500-ft. building and a 90x200-ft. warehouse. Contract for the power-house and one of the 60x200-ft. buildings, including the machinery, has been let. Power from Niagara Falls will be used.

O. J. Trainor's Son, New Iberia, La., will erect a woodworking factory, to replace one recently burned, and is in the market for machinery, including a 45 to 50-h.p. engine and a boiler.

The Lauter Co., 653-659 Broad St., Newark, N. J., piano manufacturer, will build a 5-story brick factory, with a frontage of 100 ft., at 58 to 68 Morris & Essex Railroad Ave.

Foley, Lock & Larson, Winnipeg, Man., will erect a 5-story, 103x100-ft. biscuit and candy factory. The power plant will probably consist of a 75-h.p. engine and two 90-h.p. boilers.

J. F. Marks, Ballard, Wash., is organizing the Seattle Wood Pipe & Foundry Co., and will erect a factory in Seattle. The plant will include a 62x150-ft. main building, 40x60-ft. dry kiln, 60x100-ft. storage sheds and a 30x80-ft. foundry. A 125-h.p. engine and boiler will probably be installed.

The Leaphart Lumber Co., 11 Broad St., Charleston, S. C., will erect a plant to have a daily capacity of 25,000 to 35,000 ft., with dry kiln and planing machine.

The Wilder Leather Co., Chicago, will, according to local newspaper reports, erect an 8-story, 75x126-ft. building of mill construction, to cost about $125,000. John H. Wagner, archt.

The Youngstown, O., Iron Sheet & Tube Co. expects to make some additions to its plant, but is not ready to give out information concerning the buildings to be erected or the power plant to be installed.

The Cuero, Tex., Cotton Mill will erect a plant, which will have an initial equipment of 35 machines, which will be operated electrically.

The Casper Co., Winston-Salem, N. C., will remove plant to Roanoke, Va., about July 1. Two distilleries will be erected, with a daily capacity of 200 and 50 bu. respectively; four warehouses and a 5-story, 60x120-ft. building, to be used as a rectifying and bottling house. About $100,000 will be invested.

The Hanley-Casey Co., Chicago, will, according to local newspaper reports, erect a 6-story factory building of mill construction on a 265x190-ft. lot on Ohio St. Cost, $100,000. Jenny & Mundie, archts.

The Crookston, Minn., Pressed Brick & Cement Block Co. intends to erect a factory building later in the spring.

The Co-operative Warehouse Association, Pelican Rapids, Minn., will receive bids until April 1 for a 30x30x34-ft. elevator, 24x30-ft. warehouse and 12x24 ft. engine room and office. Gasoline engine will be used. S. M. McLeod, pres.

The Pennsylvania Glass Sand Co., Lewistown, Pa., whose plant was recently burned, intends to erect a building, to be about 200x60 ft. The capacity of the plant will be about 100-h.p.

The Southern Soapstone Co., Fairmont, W. Va., has been chartered with a capital stock of $100,000, and expects to develop a quarry near Schuyler, Va., to make laundry tubs, etc. Geo. Mansbach, treas. and gen. mgr.

J. E. Smith & Co., Waterbury, Conn., will, according to local press reports, erect a 3-story, 50x124-ft. mill building of brick.

The Peters Shoe Co., St. Louis, Mo., will, according to local newspaper reports, erect a 5-story and basement, 265x55-ft. addition to its factory No. 4. Cost, $225,000. H. G. Clymer, archt. It is also stated that the company is erecting a large factory at Herman, Mo.

The Bintliff Mfg. Co., Minneapolis, Minn., whose factory was recently burned, will erect a 4-story brick building, to cost about $25,000. The building will be equipped with machinery for manufacturing moldings and picture frames.

The Ohio Leather Co., Girard, O., will erect a 4-story addition, 115 ft. in length, to its present building, a 186x115-ft. building and a 250x60-ft. building. The company's plans also call for a change from shafting to electrical power, requiring two more boilers. Estimated cost of improvements, $140,000.

The Monarch Paper Co., Kalamazoo, Mich., will erect a new two-machine mill near the site of its present mill. Dan J. Albertson, of Kalamazoo, will be the architect and engineer.

The National Phonograph Co., Orange, N. J., is stated to contemplate erecting at once in West Orange a large plant for making phonographs and storage batteries.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

**Roosevelt, Ariz.*—J. M. O'Rourke & Co., of Galveston, Tex., are reported to have secured the contract for the construction of the Roosevelt Dam on Salt River for irrigation purposes (bids opened Feb. 23) for $1,147,600. (For list of bids received for this work see issue of The Engineering Record Mar. 11.)

San Francisco, Cal.—Bids will be received by Capt. Wm. W. Harts, Corps Engrs., U. S. A., Secy. Debris Comn., Flood Bldg., on Apr. 19, for building a portion of dam known as Barrier No. 1, Yuba River, Cal., as advertised in The Engineering Record.

South Manchester, Conn.—It is proposed to lay out a new park here. Brett & Hall, Landscape Archts., are reported to have the matter in charge.

Washington, D. C.—Bids will be received Apr. 4 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at navy yards, Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C.; Norfolk, Va., and Pensacola, Fla., a quantity of naval supplies, copper cable, c. i. specials, gate valves, hot-water heating system, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

Bids will be received by the Comrs. D. C. on Apr. 15 for quarrying and crushing stone at the District Quarry, Dickerson, Md., as advertised in The Engineering Record.

Dry Tortugas, Fla.—Bids will be received Apr. 8 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for dredging at Dry Tortugas.

Chicago, Ill.—The following are the bids opened on Mar. 15 by the Superv. Archt., Treas. Dept., Washington, D. C., for auxiliary mail conveyors and other apparatus for U. S. Post Office and Court House at Chicago: Dodge Cove Storage Co., Philadelphia, $29,944; Universal Pneumatic Transmitter Co., Chicago, $12,993, and Lamson Stove Fixture Co., Boston, $23,841.

Glenwood, Ia.—See "Public Buildings."

**Chicago, Ill.*—The Lamson Consolidated Store Service Co., of Boston, Mass., has secured the contract for an auxiliary mail conveyor for the Chicago Post Office, for $84,771.

**Minneapolis, Minn.*—Ellis R. Dutton, Asst. City Engr., writes that contracts for furnishing cement have been awarded as follows: To the Guarantee Cement & Stone Co., for Portland cement, 15,000 bbl., to be delivered on work at $1.49 per bbl., and 5,000 bbl., to be delivered f. o. b. at $1.33 per bbl., and to Landers, Morrison & Co., for natural cement, 15,000 bbl. to be delivered on work at 73 cts. per bbl., and 5,000 bbl. f. o. b., at 65 cts. per bbl.

**Items marked thus give the names of parties awarded contracts.*

Point a la Hache, La.—Bids will be received Apr. 18 by the Bd. Comrs. Plaquemine Parish, East Bank Levee Dist. (Aaron Davis, Pres.), P. O. Box 326, New Orleans, for constructing about 33 miles Gulf Coast levee, containing about 1,000,000 cu. yds. earthwork.

Newton, Mass.—It is reported that bids will probably soon be asked for the construction of open and covered drains under the abolition of grade crossings in Newton Centre and Newton Highlands.

Greenwood, Miss.—The Yazoo-Mississippi Delta Bd. of Levee Comrs. (W. S. Barry, Pres., Greenwood) has sold $355,000 bonds for levee construction.

St. Louis, Mo.—Wm. B. Ladue, Secy. Mississippi River Comn., writes that the lowest bid opened on Mar. 17 for constructing and delivering a self-propelling hydraulic dredge and pontoon pipe line, was that of the Springfield Boiler & Mfg. Co., of Springfield, Ill., for $238,998.

New York, N. Y.—Bids will be received Mar. 29 by Maurice Featherson, Comr. of Docks, for furnishing material, preparing for and constructing a pier on site of pier old 22, East River, to be known as pier No. 17.

Bids will be received Mar. 29 by John F. Ahearn, Pres. Boro. Manhattan, for furnishing, delivering and erecting street signs and maintaining same for a period of 3 years.

Bids will be received until Apr. 3 by the Dept. of Docks and Ferries (Maurice Featherson, Comr.), for sprinkling on new-made land between Cortlandt and Gansevoort Sts., W. 23d and 30th Sts., North River, and E. 18th and 24th Sts., East River.

Wilmington, N. C.—The following are the bids opened on Mar. 18 by Capt. R. P. Johnston, Corps Engrs., U. S. A., for furnishing cement: (*a*) price per bbl. in bbls.; (*b*) price per bbl. in sacks: Southeastern Lime & Cement Co., Charleston, S. C., *a* $1.59; *b* $1.29. Wm. W. Palmer, Chattanooga, Tenn., *a* $1.85; *b* $1.55. Atlantic Cement Co., New York, N. Y., *a* $1.64; *b* $1.34. B. Wallis & Co., Baltimore, Md., *a* $2.15; *b* $2.25. Odell Hardware Co., Greensboro, N. C., *a* $1.58; *b* $1.28. Carolina Portland Cement Co., Charleston, S. C., *a* $1.82; *b* $1.52. Atlas Portland Cement Co., New York, N. Y., *a* $1.51; *b* $1.20. Roger Moore's Sons & Co., Wilmington, *a* $1.79; *b* $1.44.

Kenton, O.—It is stated that bids are wanted Apr. 8 by J. W. Gilmore, Co. Surv., Kenton, for constructing Bodell Ditch, consisting of deepening and widening channel of Hog Creek, requiring about 7½ miles of earthwork and 3½ miles of rock-work excavation. Estimated cost, $37,555.

Cleveland, O.—See "Sewerage and Sewage Disposal."

Pittsburg, Pa.—Bids will be received by Maj. Wm. L. Sibert, Corps Engrs., U. S. A., on Apr. 17 for building Dam No. 2 at Six-Mile Island, Allegheny River; also on same date for building 100-ft. of Chanoine Dam, 2 bear-trap dam foundations ea. 93 ft. long, a Chanoine weir, 3 piers and abutment, Dam No. 3, Ohio River, at Glenosborne, Pa. Bids will also be received on Apr. 18 for work on Dam No. 5, near Freedom, Pa., and on Apr. 19 for work on Dam No. 4, near Legionville, Pa., all four advertised in The Engineering Record.

Newport, R. I.—Wm. H. Lawton, City Engr., writes in regard to improvements contemplated to the Long Wharf, that plans have not yet been approved, and no appropriation has been asked for.

Wheeling, W. Va.—The following are the bids for furnishing and delivering 7,500 bbl. American Portland cement for Dam No. 13, Ohio River, opened at Wheeling, W. Va., Mar. 14, by Maj. Geo. A. Zinn, Corps Engrs., U. S. A.—*a*, price per bbl.; *b*, brand: The Cleveland Builders' Supply Co., Cleveland, O., *a*, $1.40; *b*, Pennsylvania. Atlas Portland Cement Co., New York, N. Y., *a*, $1.32; *b*, Atlas. Commercial Wood & Cement Co., New York, N. Y., *a*, $1.48; *b*, Saylors. Alpha Portland Cement Co., Easton, Pa., *a*, $1.34; *b*, Alpha. The Kelley Island Lime & Transport Co., Cleveland, O., *a*, $1.48; *b*, Lehigh. Atlantic Cement Co., New York, N. Y., *a*, $1.40; *b*, Atlantic. D. J. Kennedy Co., Pittsburg, Pa., *a*, $1.35; *b*, Lehigh.

Panama.—Bids will be received Apr. 19 by the Isthmian Canal Comn., at the office of Maj. H. J. Gallagher, U. S. A., Purchasing Agent, Washington, D. C., for saws, parts of french cars, planers, asbestos packing, steam wrecker, steel sheeting, etc.

Richibucto, N. B.—It is stated that bids will be received by the Dept. of Pub. Wks. at Ottawa, Ont., until Apr. 3 for constructing an extension to breakwater here.

Sydney, N. S.—Capt. J. A. Farquhar, of Halifax, is reported interested in the construction of a steel railway dry dock for North Sydney; probable cost $250,000.

PROPOSALS OPEN

For Proposals see pages 34, 35, 51, 52 and 53

WATER WORKS.

Bids Close.		See Eng. Record.
Mar. 28.	Coal pocket, etc., Atlantic City, N. J. Adv. Feb. 25, Mar. 4.	Feb. 25
Mar. 29.	Supplies, Bradley, Ill.	Mar. 18
Mar. 29.	Ft. Sill, Okla. Ter.	Mar. 4
Mar. 29.	Meters, Cleveland, O.	Mar. 25
Mar. 29.	Valves, Baltimore, Md.	Mar. 25
Mar. 30.	Spooner, Wis.	Mar. 25
Mar. 31.	Meters, Pocatello, Idaho	Jan. 28
Mar. 31.	Pipe, Chicago, Ill. Adv. Jan. 28 to Feb. 18.	Mar. 25
Mar. —.	Sylacauga, Ala.	Feb. 28
Mar. —.	Smith's Grove, Ky.	Jan. 7
Apr. 1.	Reservoir, etc., Montrose, Colo., Adv. Mar. 11 to 25	Mar. 11
Apr. 1.	Shippensburg, Pa.	Mar. 25
Apr. 1.	Irrig., Usk, Wash.	Dec. 24
Apr. 3.	Pumping station, Canton, O.	Mar. 18
Apr. 3.	Pumping engine Clarksville, Tenn., Adv. Mar. 18	Mar. 18
Apr. 3.	Canal work, Cody, Wyo.	Mar. 11
Apr. 3.	Boilers, Chicago, Ill.	Mar. 25
Apr. 3.	Pump, etc., Prescott, Ariz.	Mar. 25
Apr. 4.	Well, Poplarville, Miss. Adv. Mar. 18, 25.	Mar. 18
Apr. 4.	Well, Lumberton, Miss. Adv. Mar. 18, 25.	Mar. 18
Apr. 4.	Ellisville, Miss. Adv. Mar. 25.	Mar. 25
Apr. 6.	Submarine pipe line, Boston, Mass.	Mar. 11
Apr. 6.	New Albany, Miss. Adv. Mar. 18, 25.	Mar. 18
Apr. 7.	Boilers, Chicago, Ill.	Mar. 25
Apr. 10.	Main supply canal, Belle Fourche, S. D. Adv. Feb. 18 to Mar. 25.	Feb. 18
Apr. 10.	Pipe & Spcls., Winnipeg, Man. Adv. Feb. 18 to Mar. 11.	Feb. 18
Apr. 11.	Engine, Elyria, O. Adv. Mar. 25.	Mar. 25
Apr. 12.	Portage Le Prairie, Man.	Mar. 11
Apr. 12.	Pipe line, etc., St. John, N.B. Adv. Mar. 25.	Mar. 25
Apr. 15.	Alma, Neb.	Mar. 11
Apr. 15.	Cookeville, Tenn.	Mar. 25
Apr. 15.	Connellsville, Pa.	Mar. 25
Apr. 17.	Pipe line, etc., Augusta, Me. Adv. Mar. 25.	Mar. 25
Apr. 18.	Pumping engine, Toronto, Ont., Adv. Mar. 11, 18	Mar. 18
Apr. 18.	New Orleans, La. Adv. Feb. 11 to Mar. 25.	Feb. 11
Apr. 25.	Canal, pipe, etc., N. Orleans, La., Adv. Feb. 18 to Mar. 25	Feb. 18
May 1.	Shirley, Ind.	Feb. 11
May 11.	Pipe, New Orleans, La.	Mar. 25
May 14.	System, Mansfield, La. Adv. Mar. 4, 11.	Mar. 4
May 15.	Engine, etc., Montreal, Que. Adv. Mar. 11.	Mar. 11
May 16.	Irrig. work, North Platte, Neb. Adv. Mar. 25.	Mar. 25

SEWERAGE AND SEWAGE DISPOSAL.

Mar. 27.	Atlantic City, N. J. Adv. Mar. 18.	Mar. 18
Mar. 27.	Providence, R. I.	Mar. 25
Mar. 27.	Muscatine, Ia.	Mar. 25
Mar. 28.	Dravosburg, Pa.	Mar. 18
Mar. 29.	Columbus, O. Adv. Mar. 18, 25.	Mar. 18
Mar. 29.	Cincinnati, O.	Mar. 11
Mar. 29.	Neodesha, Kan., Adv. Mar. 11.	Mar. 11
Mar. 29.	Portsmouth, O.	Mar. 11
Mar. 29.	Ft. McIntosh, Tex.	Mar. 4
Mar. 29.	Columbus, O.	Mar. 25
Mar. 31.	Minneapolis, Minn.	Mar. 18
Mar. 31.	Salem, Mass. (2 prop.) Adv. Mar. 11 to 25.	Mar. 11
Mar. 31.	Cincinnati, O.	Mar. 25
Apr. 3.	Kirkwood, Mo.	Mar. 18
Apr. 3.	Richmond, Ind.	Mar. 18
Apr. 3.	Ft. Leavenworth, Kan. Adv. Mar. 11 to 25.	Mar. 11
Apr. 3.	Long Island City, L. I., N. Y.	Mar. 25
Apr. 3.	Grinnell, Ia.	Mar. 25
Apr. 5.	Logansport, Ind.	Mar. 11
Apr. 5.	St. Joseph, Mo. Adv. Mar. 11.	Mar. 11
Apr. 7.	Ft. Wood, N. Y. H., N. Y. Adv. Mar. 11 to 25.	Mar. 11
Apr. 10.	Menominee, Mich. Adv. Mar. 18, 25.	Mar. 18
Apr. 10.	Regina, N. W. Ter.	Mar. 25
Apr. 10.	Scottville, Mich.	Mar. 25
Apr. 12.	Portage La Prairie, Man.	Mar. 11
Apr. 15.	Puyallup, Wash.	Mar. 25
Apr. 18.	New Orleans, La. Adv. Feb. 11 to Mar. 25.	Feb. 18

BRIDGES.

Mar. 28.	Louisa, Ky.	Mar. 18
Mar. 28.	Welland, Ont.	Mar. 11
Mar. 29.	Hutchinson, Minn.	Mar. 25
Mar. 30.	Columbus, O.	Mar. 11
Mar. 30.	Providence, R. I. (2 prop.) Adv. Feb. 18 to Mar. 18.	Feb. 18
Mar. 30.	Manistee, Mich.	Feb. 25
Apr. 3.	Devil's Lake, N. D.	Mar. 25
Apr. 4.	Dayton, O. Adv. Mar. 25.	Mar. 25
Apr. 3.	Atlanta, Ga., Adv. Mar. 18, 25	Mar. 18
Apr. 4.	Columbus, Ga.	Mar. 4
Apr. 4.	Spokane, Wash.	Mar. 4
Apr. 4.	Alma, Neb.	Feb. 18
Apr. 4.	Goldendale, Wash.	Feb. 11
Apr. 4.	Middletown, Ind.	Mar. 25
Apr. 5.	Smithland, Ky.	Mar. 18
Apr. 5.	Birmingham, Ala.	Mar. 18
Apr. 5.	Indianapolis, Ind.	Mar. 18
Apr. 5.	Langdon, N. Dak.	Mar. 11
Apr. 5.	Dakotah, Ia.	Mar. 25
Apr. 5.	Goldbeach, Ore.	Mar. 25
Apr. 6.	Warrenton, Mo.	Mar. 18
Apr. 6.	Bluffton, Ind.	Mar. 18
Apr. 6.	Wabash, Ind.	Feb. 25
Apr. 7.	Anoka, Minn.	Mar. 25
Apr. 8.	Bloomfield, Ind.	Mar. 25
Apr. 8.	Springfield, Mass. Adv. Mar. 25.	Mar. 25
Apr. 10.	Townsend, Mont.	Mar. 25
Apr. 10.	Tillamook, Ore.	Mar. 25
Apr. 12.	Cleveland, O.	Mar. 25
Apr. 13.	Jackson, O.	Mar. 25
Apr. 19.	Moscow, Idaho	Mar. 11
Apr. 21.	Cincinnati, O.	Mar. 25
May 1.	Richland, Ark.	Mar. 11

PAVING AND ROADMAKING.

Mar. 27.	Long Island City, L. I., N. Y.	Mar. 18
Mar. 27.	Atlantic City, N. J. Adv. Mar. 18.	Mar. 18
Mar. 27.	Indianapolis, Ind.	Mar. 25
Mar. 27.	Syracuse, N. Y.	Mar. 25
Mar. 28.	New Brighton, S. I., N. Y.	Mar. 18
Mar. 28.	Philadelphia, Pa.	Mar. 25
Mar. 28.	Troy, N. Y.	Mar. 25
Mar. 29.	Brooklyn, N. Y.	Mar. 18
Mar. 29.	Lima, O.	Mar. 11
Mar. 29.	Cincinnati, O.	Mar. 11
Mar. 29.	Baltimore, Md.	Mar. 25
Mar. 29.	New York, N. Y.	Mar. 25
Mar. 29.	Chicago, Ill.	Mar. 25
Mar. 30.	Brooklyn, N. Y.	Mar. 18
Mar. 31.	Detroit, Mich.	Mar. 11
Mar. 31.	Minneapolis, Minn.	Mar. 25
Mar. 31.	Dayton, O.	Mar. 25
Mar. 31.	Greenville, O.	Mar. 25
Mar. 31.	Brick Plant, Detroit, Mich.	Mar. 25
Mar. —.	Tacoma, Wash.	Mar. 4
Apr. 1.	Norwood, O.	Mar. 11
Apr. 1.	Acton, Ont.	Mar. 25
Apr. 1.	Fort Myer, Va. Adv. Mar. 25.	Mar. 25
Apr. 2.	Bedford, Ind.	Mar. 25
Apr. 3.	Michigan City, Ind.	Mar. 18
Apr. 3.	Montgomery, Ala.	Mar. 11
Apr. 3.	Wilkesbarre, Pa.	Mar. 18
Apr. 3.	Bowling Green, O.	Mar. 25
Apr. 3.	White Plains, N. Y.	Mar. 25
Apr. 3.	Dayton, Wash.	Mar. 25
Apr. 3.	Long Island City, L. I., N. Y.	Mar. 25
Apr. 3.	Cortland, N. Y.	Mar. 25
Apr. 4.	Greenville, Miss.	Mar. 18
Apr. 4.	Bloomfield, Ind.	Mar. 18
Apr. 4.	Marion, Ind.	Mar. 25
Apr. 4.	Buffalo, N. Y.	Mar. 25
Apr. 4.	Amsterdam, N. Y. Adv. Mar. 25.	Mar. 25
Apr. 5.	Peru, Ind.	Mar. 4
Apr. 5.	Paoli, Ind.	Mar. 25
Apr. 10.	Ft. Mott, N. J. Adv. Mar. 18, 25.	Mar. 18
Apr. 10.	Lafayette, Ind.	Mar. 25
Apr. 10.	Uhrichsville, O.	Mar. 25
Apr. 10.	Menominee, Mich. Adv. Mar. 18, 25.	Mar. 18
Apr. 10.	Bowling Green, O.	Mar. 25
Apr. 10.	Ft. Schuyler, N. Y.	Mar. 25
Apr. 10.	Cincinnati, O.	Mar. 25
Apr. 10.	Braddock, Pa.	Mar. 25
Apr. 14.	Minneapolis, Minn.	Mar. 25
Apr. 14.	Cincinnati, O.	Mar. 25
Apr. 15.	Sullivan, Ind.	Mar. 25
Apr. 15.	Cookeville, Tenn.	Mar. 25
Apr. 17.	Cincinnati, O.	Mar. 25
Apr. 21.	Cincinnati, O.	Mar. 25
Apr. 30.	Vicksburg, Miss.	Mar. 25
Apr. 18.	La Crosse, Wis.	Feb. 25
May 1.	Parkridge, Ill.	Mar. 11

POWER, GAS AND ELECTRICITY.

Mar. 27.	New York, N. Y.	Mar. 18
Mar. 28.	Washington, D. C.	Mar. 18
Mar. 28.	Dover, N. J.	Mar. 4
Mar. 28.	Philadelphia, Pa.	Mar. 25
Mar. 30.	Chickamauga Park, Ga. Adv. Mar. 11 to 25.	Mar. 11
Mar. —.	Sylacauga, Ala.	Feb. 25
Apr. 1.	Portsmouth, N. H.	Mar. 11
Apr. 1.	Wernersville, Pa.	Mar. 11
Apr. 1.	Fairmont, Neb.	Mar. 25
Apr. 3.	Lakeport, Cal.	Mar. 4
Apr. 3.	Cape Charles, Va. Adv. Feb. 25.	Feb. 25
Apr. 3.	Brooklyn, N. Y.	Mar. 25
Apr. 4.	Indianapolis, Ind.	Mar. 25
Apr. 4.	Brooklyn, N. Y.	Mar. 25
Apr. 6.	New Albany, Miss. Adv. Mar. 18, 25.	Mar. 18
Apr. 10.	Ocean Park, Cal.	Mar. 25
Apr. 11.	Shreveport, La.	Feb. 18
Apr. 11.	Washington, D. C.	Mar. 25
Apr. 12.	Lockport, Ill. Adv. Feb. 18.	Feb. 18
Apr. 15.	Alma, Neb.	Mar. 11
Apr. 15.	Cookeville, Tenn.	Mar 25
Apr. 15.	Harrisburg, Ark.	Mar. 18
Apr. 27.	Ligonier, Ind., Adv. Mar. 25.	Mar. 25
Apr. —.	Ft. Valley, Ga.	Jan. 21
May 1.	Empire, Colo.	Mar. 18
May 1.	Shirley, Ind.	Feb. 11
May 2.	Modesto, Cal.	Mar. 25
May 15.	Jewell City, Kan.	Mar. 18
May —.	Meridian, Miss.	Mar. 25

BUILDINGS.

Mar. 27.	School, New Brighton, S. I., N. Y.	Mar. 18
Mar. 27.	School, New York, N. Y.	Mar. 18
Mar. 27.	School, Boston, Mass.	Mar. 18
Mar. 27.	School, Brooklyn, N. Y.	Mar. 18
Mar. 27.	Library, Attleboro, Mass.	Mar. 11
Mar. 27.	P. O. Bldg., Lebanon, Pa. Adv. Feb. 11, 18.	Feb. 11
Mar. 27.	Town Hall, Carrick, Pa.	Mar. 25
Mar. 28.	School, Indianapolis, Ind.	Mar. 11
Mar. 28.	P. O. Bldg., Superior, Wis.	Feb. 11
Mar. 28.	Pub. Bldg., New York, N. Y.	Mar. 25
Mar. 28.	School, Philadelphia, Pa.	Mar. 25
Mar. 28.	Fire escapes, City Hall, Chicago, Ill.	Mar. 25
Mar. 28.	Engine House, Chicago, Ill.	Mar. 25
Mar. 29.	Ch[illegible]ch, Toronto, Ont.	Mar. 25
Mar. 29.	Dormitory, New York, N. Y.	Mar. 18
Mar. 29.	Pub. Bldg. material, Washington, D. C., Adv. Mar. 18, 25	Mar. 18
Mar. 29.	Bldg. material, Ft. Liscum, Alaska	Mar. 25
Mar. 29.	Naval Academy, Annapolis, Md.	Mar. 25
Mar. 30.	Church, Hartford, Ind.	Mar. 18
Mar. 30.	Church, Clinton, Ia.	Mar. 18
Mar. 30.	Post Bldg., Ft. Riley, Kan. Adv. Mar. 11 to 25.	Mar. 11
Mar. 30.	Bus. Bldg., Evansville, Ind.	Mar. 18
Mar. 30.	Htg., P. O., Waterloo, Ia.	Mar. 11
Mar. 30.	Church, Leamington, Ont.	Mar. 25
Mar. 30.	Church, Kewanee, Ill.	Mar. 25
Mar. 30.	Hotel, Terre Haute, Ind.	Mar. 25
Mar. 30.	Htg. School, Louisville, Ky.	Mar. 25
Mar. 31.	Pub. Bldg., Ft. Greble, R. I.	Mar. 18
Mar. 31.	School, Petersboro, Ont.	Mar. 11
Mar. 31.	School, Cleveland Heights, O.	Mar. 4
Mar. —.	Theatre, Philadelphia, Pa.	Mar. 4
Mar. —.	School, Klamath Falls, Ore.	Jan. 28
Mar. 31.	Jail, etc., Glasgow, Ky.	Mar. 25
Apr. 1.	Church, Champaign, Ill.	Mar. 18
Apr. 1.	Foundation for Pub. Bldg., Chicago, Ill.	Mar. 18
Apr. 1.	Elks Bldg., Los Angeles, Cal.	Mar. 18
Apr. 1.	Court House, Corsicana, Tex.	Mar. 11
Apr. 1.	Schools, Curtice, O.	Mar. 11
Apr. 1.	Court House, Baraboo, Wis.	Feb. 18
Apr. 1.	Y. M. C. A. plans, Bingham-	
Apr. 1.	Church, Raleigh, N. C.	Mar. 25
Apr. 3.	School, Shamokin, Pa.	Mar. 25
Apr. 3.	Court House, Hollidaysburg, Pa.	Mar.
Apr. 3.	School, Brooklyn, N. Y.	Mar.
Apr. 3.	City Hall, Oskaloosa, Ia.	Mar.
	ton, N. Y.	Feb.
Apr. 3.	Hospital, Lincoln, Neb.	Mar.
Apr. 3.	School, Cleveland, O.	Mar.
Apr. 3.	Bus. Bldg., Cincinnati, O.	Mar.
Apr. 3.	School, Muncie, Ind.	Mar.
Apr. 3.	Court House, Kentland, Ind.	Feb.
Apr. 3.	P. O. Bldg., Macon, Ga.	Feb.
Apr. 3.	Court House, Newton, Ind.	Feb.
Apr. 4.	Police sta., New Haven, Conn.	Mar.
Apr. 4.	School, Hattiesburg, Miss.	Mar.
Apr. 4.	Stable, Brooklyn, N. Y.	Mar.
Apr. 4.	School, Covington, Ky.	Mar.
Apr. 4.	Pub. Bldg., Glenwood, Ia.	Mar.
Apr. 5.	Hospital, Charleston, S. C.	Mar.
Apr. 5.	Post Bldgs., Ft. McKinley, Me.	Mar.
Apr. 5.	Court House plans, New Orleans, La.	Dec.
Apr. 5.	School, Edgeley, N. D.	Mar.
Apr. 5.	Poor House, Winona, Minn.	Mar.
Apr. 5.	School, Walkerville, Ont.	Mar.
Apr. 5.	School, Iowa City, Ia.	Mar.
Apr. 6.	Post Office, Marblehead, Mass. Adv. Mar. 4, 11.	Mar.
Apr. 6.	Hospital, Birmingham, Ala.	Mar.
Apr. 8.	Court House Plans, Deadwood, S. D.	Mar.
Apr. 6.	Hospital, Retreat, Pa.	Mar.
Apr. 7.	School, Freeport, Ill.	Mar.
Apr. 10.	School, Ithaca, N. Y. Adv. Mar. 4 to 18.	Mar.
Apr. 10.	Court House, Seward, Neb.	Mar.
Apr. 10.	Court House, Columbia, Miss.	Mar.
Apr. 10.	Court House, Tillamook, Ore.	Mar.
Apr. 11.	Pub. Bldg., Washington, D. C. Adv. Mar. 25.	Mar.
Apr. 12.	Jail, Oakland, Md.	Mar.
Apr. 12.	Court House, Marion, Va.	Mar.
Apr. 13.	Court House, Douglas, Wyo.	Mar.
Apr. 15.	Court House, Corsicana, Tex.	Mar.
Apr. 15.	Court House, Grundy, Va.	Feb.
Apr. 15.	Church, Trenton, Ky.	Mar.
Apr. 17.	School, Richmond, Va.	Mar.
Apr. 18.	Pub. Bldg., St. Joseph, Mo.	Mar.
Apr. —.	School, New Haven, Conn.	Mar.
Apr. 18.	Library, Cincinnati, O.	Mar.
Apr. 20.	Officers' quarters, etc., West Point, N. Y. Adv. Mar. 25.	Mar.
Apr. —.	Asylum, Jamestown, N. D.	Mar.
Apr. 30.	Court House, Wynne, Ark.	Mar.
May 1.	College plans, Washington, D. C.	Mar.
May 8.	Interior finish, U. S. Custom House, New York, N. Y., Adv. Mar. 11, 18	Mar.
May 9.	Mech. Equip. U. S. Custom House, New York, N. Y., Adv. Mar. 11, 18	Mar.
Jun. 15.	Court House plans, New Orleans, La.	Feb.

MISCELLANEOUS.

Mar. 27.	Pier, New York, N. Y.	Mar.
Mar. 27.	Trap Rock, etc., Long Island City, L. I., N. Y.	Mar.
Mar. 27.	Coal & Ash Handling Machinery, Washington, D. C., Adv. Mar. 18	Mar.
Mar. 27.	Riprap embankment, Ft. Strong, Mass.	Mar.
Mar. 28.	St. Sprinklers, Winnipeg, Man., Adv. Mar. 18	Mar.
Mar. 28.	Steel Shed, New Orleans, La.	Mar.
Mar. 28.	Drainage, Grant Park, Ill. Adv. Mar. 11.	Mar.
Mar. 29.	Screens, Ft. Mott, N. J. Adv. Mar. 11 to 25.	Mar.
Mar. 29.	St. Sprinkling, Indianapolis, Ind.	Mar.
Mar. 29.	Pier, New York, N. Y.	Mar.
Mar. 29.	St. signs, New York, N. Y.	Mar.
Mar. 30.	Coal conveying apparatus, West Point, N. Y. Adv. Mar. 11 to 25.	Mar.
Mar. 30.	Rock excav., Boston, Mass. Adv. Mar. 4 to 25.	Mar.
Mar. 31.	El. Ry., Shanghai, China	Oct.
Apr. 3.	Sanitary & Roughing material, Panama	Mar.
Apr. 3.	Breakwater extension, Richibucto, N. B.	Mar.
Apr. 3.	Sprinkling, New York, N. Y.	Mar.
Apr. 4.	Cement, Winnipeg, Man. Adv. Mar. 11, 18.	Mar.
Apr. 4.	Ditch, Fairmont, Minn.	Feb.
Apr. 4.	Supplies, Washington, D. C.	Mar.
Apr. 6.	El. ry. franchise, National City, Cal.	Mar.
Apr. 8.	Dredging, Dry Tortugas, Fla.	Mar.
Apr. 8.	Ditch work, Kenton, O.	Mar.
Apr. 10.	Channel work, Bermuda	Feb.
Apr. 10.	St. ry. franchise, Los Angeles, Cal.	Mar.
Apr. 11.	Supplies, Washington, D. C.	Mar.
Apr. 11.	Foundry equipment, Philadelphia, Pa.	Mar.
Apr. 13.	Cement, Panama	Mar.
Apr. 14.	Cement, stone, etc., Ft. Revere, Mass. Adv. Mar. 18, 25.	Mar.
Apr. 15.	R. R. work, Norfolk, Va. Adv. Mar. 11 to 25.	Mar.
Apr. 15.	Electric crane, Bremerton, Wash.	Mar.
Apr. 15.	Crushing stone, Washington, D. C., Adv. Mar. 25	Mar.
Apr. 17.	Dam No. 2, Pittsburg, Pa. Adv. Mar. 18, 25.	Mar.
Apr. 17.	Dam No. 3, Pittsburg, Pa. Adv. Mar. 18, 25.	Mar.
Apr. 18.	Dam No. 5, Pittsburg, Pa. Adv. Mar. 25.	Mar.
Apr. 18.	Levee work, Point a la Hache, La.	Mar.
Apr. 19.	Dam No. 4, Pittsburg, Pa. Adv. Mar. 25.	Mar.
Apr. 19.	Dam, San Francisco, Cal. Adv. Mar. 25.	Mar.
Apr. 19.	Supplies, Panama	Mar.
Apr. 25.	Dredging, New Orleans, La.	Mar.
Apr. 29.	Coal handling plant, New Orleans, La.	Mar.
May 6.	Quay Wall, Bremerton, Wash.	Mar.
May 10.	Ditch, Stevens Point, Wis.	Feb.

**Items marked thus give the names of parties awarded contracts.*